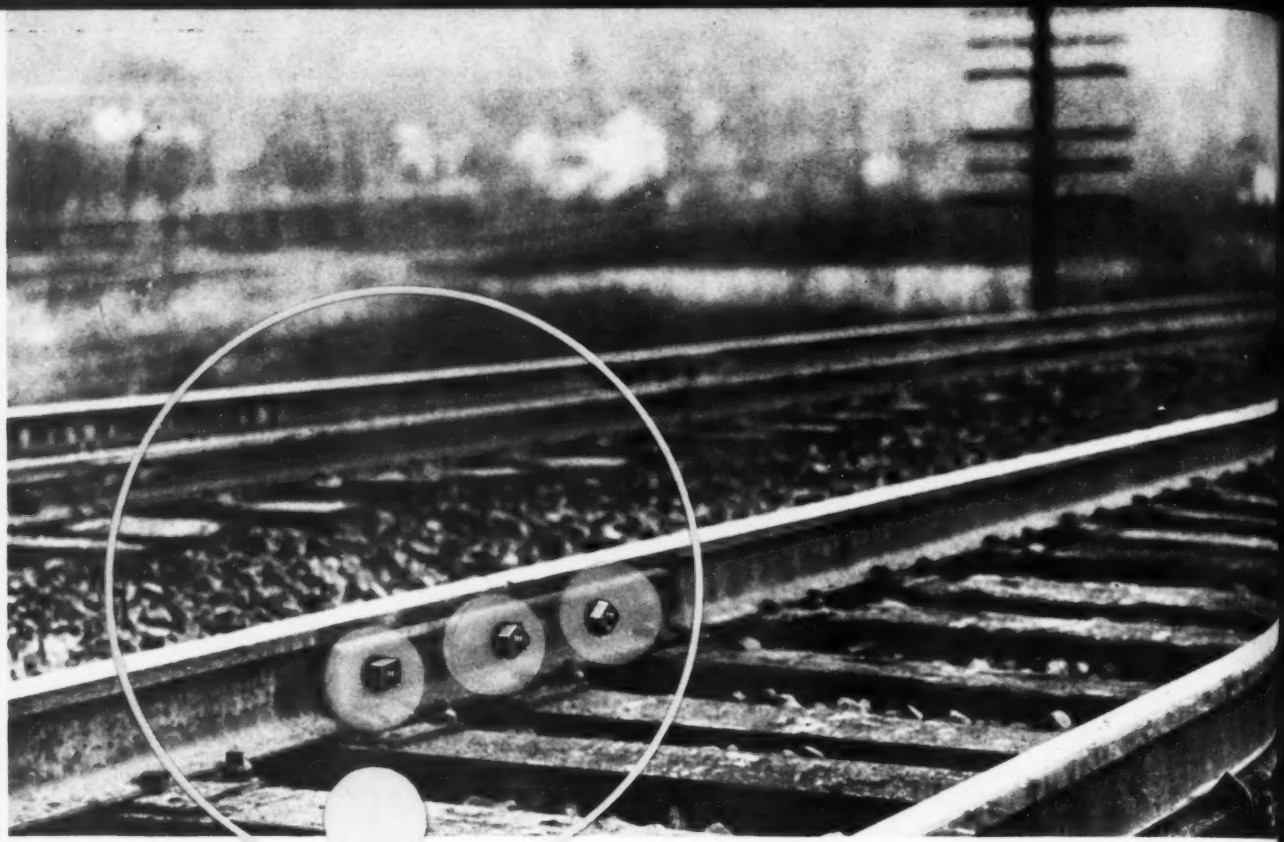
THE IMPROVED FAIR RAIL ANCHOR
IT GRIPS - IT HOLDS
THE P.&.M. CO.
CHICAGO • NEW YORK • CLEVELAND
DENVER • ST. LOUIS • SAN FRANCISCO
WASHINGTON • ST. PAUL • BOSTON
Pacific Lines



smoother riding track

Reliance Hy-Pressure Hy-Crome Spring Washers contribute to smoother riding track by maintaining rail joint bolts under proper tension, thus improving track-joint and rail-end conditions.

Your new rail laying program can go through on schedule if Reliance Hy-Pressure Hy-Crome Spring Washers are specified and used on track-joint bolts. Dependable and prompt delivery service of Reliance Hy-Pressure Hy-Crome Spring Washers backed by adequate inventories and prompt experienced personnel, will not hold up your laying gangs and create unnecessary expense and delay.

WRITE for Railroad Track Folder showing the many spring washers of the Hy-Crome family used on track and track accessories.

Reliance **HY-PRESSURE HY-CROME**
spring washers

EATON
EATON MANUFACTURING COMPANY

RELIANCE DIVISION
Office and plant MASSILLON, OHIO

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Straight Talk On Replacement Parts

For your protection and ours, make it a rule to insist on Bethlehem replacement parts for equipment designed and currently manufactured by Bethlehem.

Parts for Bethlehem-designed track products are made to exacting specifications and machined to close tolerances in accurate jigs. They are carefully inspected by experienced supervisors who know what is required of each component. Any part that does not meet these high specifications is immediately rejected by our own shops and laboratories.

When you use Bethlehem equipment, we strongly recommend that the following three "Don'ts" be given particular attention:

DON'T use replacement parts of unknown origin, simply because they happen to fit.

DON'T use parts taken from, or intended for, non-Bethlehem products. This is no attempt to disparage the products of other manufacturers. But Bethlehem parts are made specifically for Bethlehem devices, and no substitutes can be expected to do the job as well.

DON'T use "home-made" replacement parts when parts are obtainable from the manufacturer. It is difficult for any shop to estimate, and duplicate, the precise properties of the original items.

★ BETHLEHEM STEEL ★

Remember...

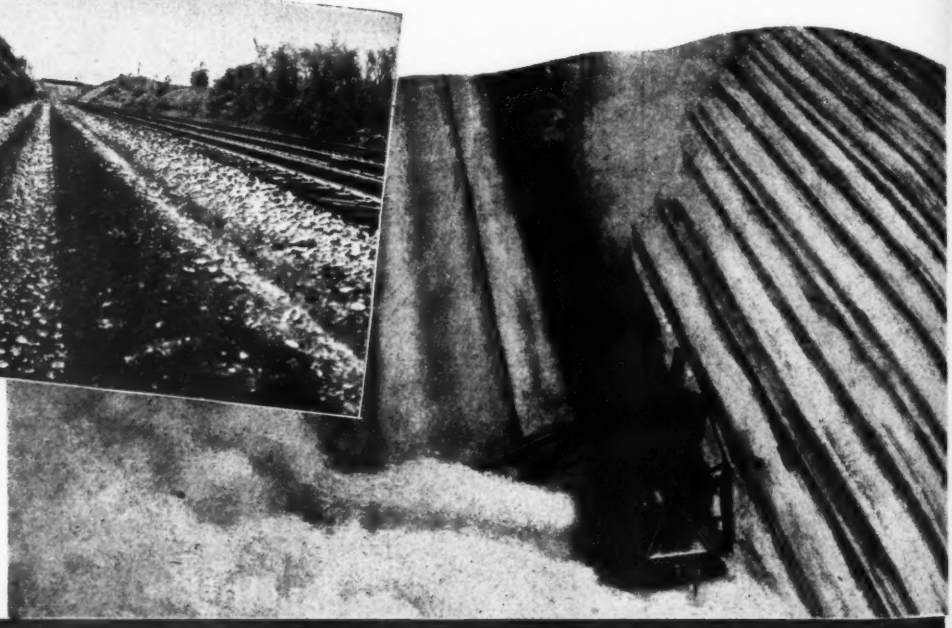
USE ONLY BETHLEHEM PARTS FOR BETHLEHEM TRACK EQUIPMENT

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.

Jordan with wing in carrier position drags dirt from cut to establish drainage.

Approximately 7 cubic yards being dragged out by one wing—a Type A Jordan.

Finished ditch means effective drainage and a roadbed far more economical to maintain.



The Jordan has no equal for keeping yard tracks clear of snow—cleans two tracks at once.

Three essential maintenance tools

IN ONE—

THE MIGHTY

JORDAN

SPREADER—DITCHER—SNOW PLOW

You quickly get back the cost of this versatile giant in better track maintenance at much lower cost.

In dry seasons the Jordan shapes and contours the roadbed, cuts ditches, forms permanent bank slopes to exact specifications—establishes the good drainage essential to handling modern traffic.

During snowy weather the Jordan is the fastest method for clearing classification yards—cleans two or even three tracks at once; backs drifts and flanges in one operation; keeps the lines open.

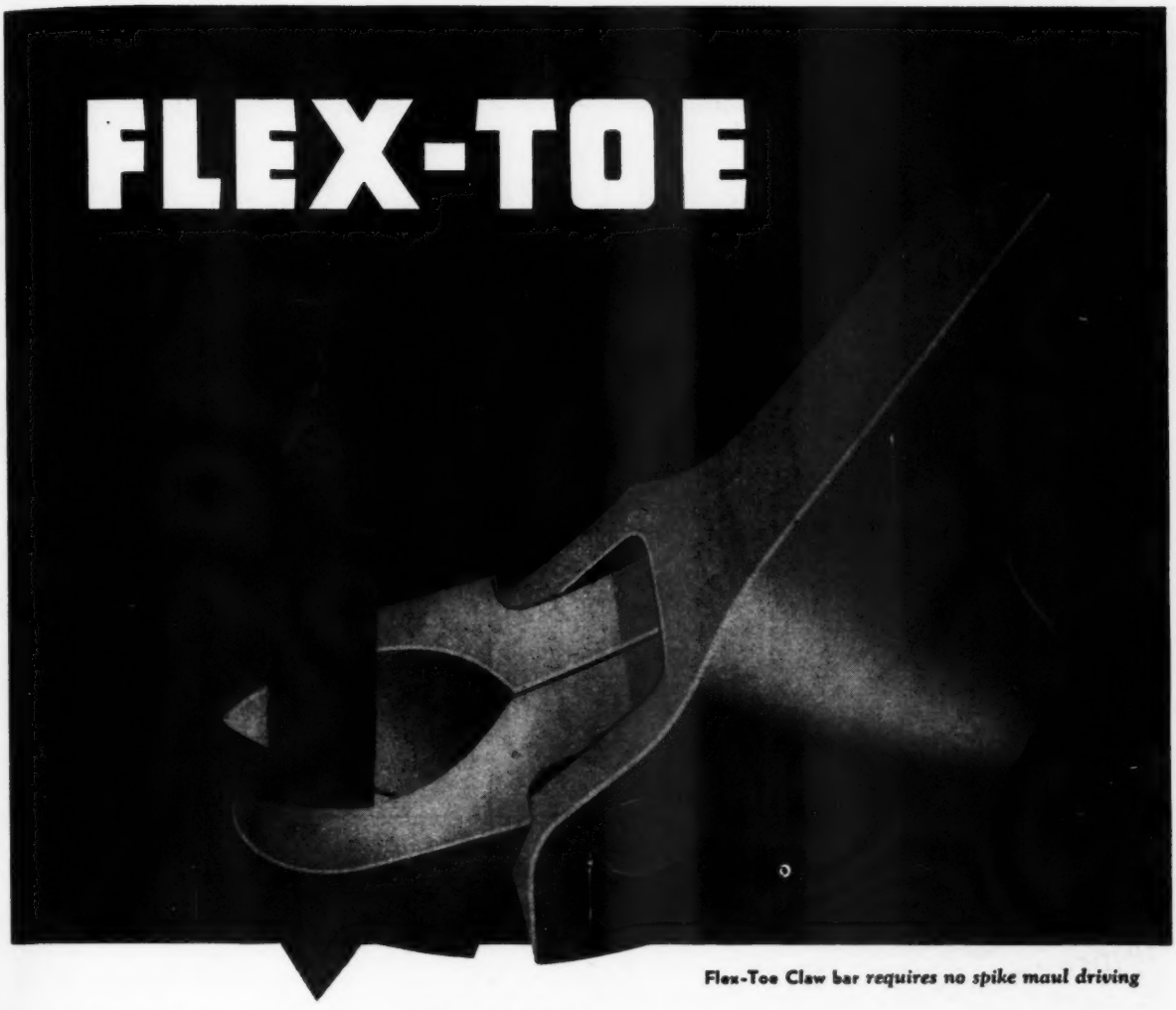
You can *see* the Jordan at work in the new Jordan Book—more than 100 action and structural pictures. Sent to industrial executives when requested on business letterheads.

O. F. JORDAN COMPANY

WALTER J. RILEY, *President*

EAST CHICAGO, INDIANA

FLEX-TOE



Flex-Toe Claw bar *requires no spike maul driving*

Quit driving stubs down through the ties . . .

Save your ties with Flex-Toe claw bars. Maintenance men have found that Flex-Toe bars will even remove spikes in tunnels where the heads have been eaten away by sulphur fumes.

Here is why! The Flex-Toe *grips* the spike. It is used in the same way as the AREA claw bar. Throw the Flex-Toe on the spike until the toes grip... lift the handle slightly, *then come down*—and as this is done, the bar grips and cracks the spike easier than any other bar.

Fewer men pull more spikes; ordinary spikes, headless spikes, stubs, brine-eaten spikes, drift bolts, boat spikes come out easily. Write today for literature and prices.

WARREN TOOL CORP.

FACTORY - WARREN, OHIO

General Sales Offices - 105 W. Adams St., Chicago, Ill.

FOR SAFETY - IT'S Morden

SECURITY ADJUSTABLE RAIL BRACE

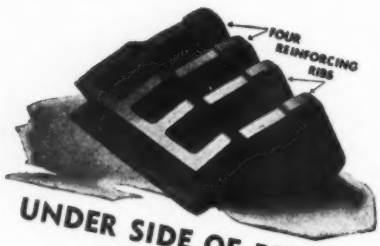
IN SERVICE ON MAJOR RAILROADS SINCE 1920

THE improved Morden Security Brace is specially designed to meet the needs of heavy, high-speed traffic by providing adequate support for rails subjected to the thrust of heavy wheel loads. The Brace is adapted particularly for use in split switches and slip switches in interlocked territory where it is essential to hold stock rails to proper gage and alinement.

Simple in design, the Brace can be quickly installed, adjusted or removed, without disturbing either rail, tie, or plate. Rigorous loading tests have shown that the Security Brace will support a weight of 50,000 lbs. at a 45 deg. angle, with a spread of only 1/8 in., and a spread of only one inch when this weight is raised to 200,000 lbs.

COMPLETE BRACE ASSEMBLY

INDIVIDUAL PARTS OF BRACE



UNDER SIDE OF BRACE

Four reinforcing vertical ribs, which extend from rail web to floor of brace plate, afford the greatest possible structural strength to the design.

For more than 60 years Morden has pioneered in the construction of frogs, switches, crossings, guard rails, gage rods, rail braces and security track work. Let our engineers help you solve your track maintenance problems.

DESIGNED and built to conform to either A.R.E.A. or customer's specifications, the complete assembly of the Morden Security Split Switch combines the Samson Heavy Duty Switch Point and the Betts switch plate. These details are designed to assure safe operation and promote substantial reductions in maintenance costs.

Braced with a Morden Security Adjustable Rail Brace, additional protection is afforded against the shocks of heavy traffic.

SECURITY SPLIT SWITCH

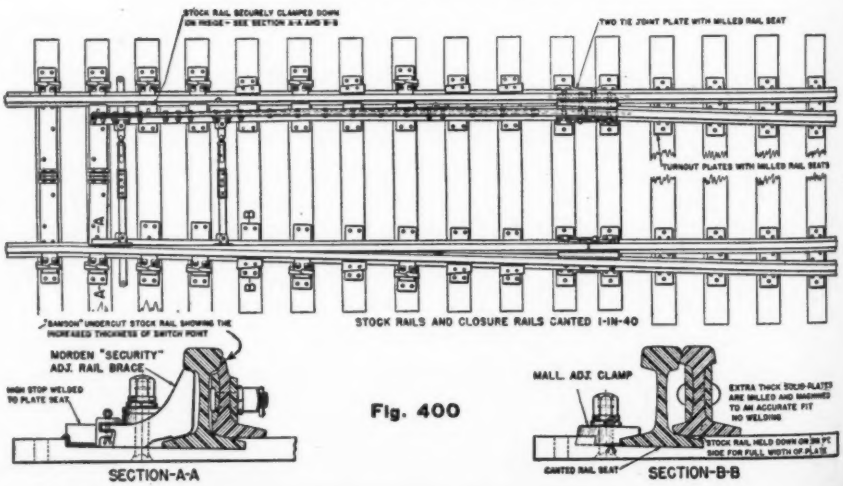
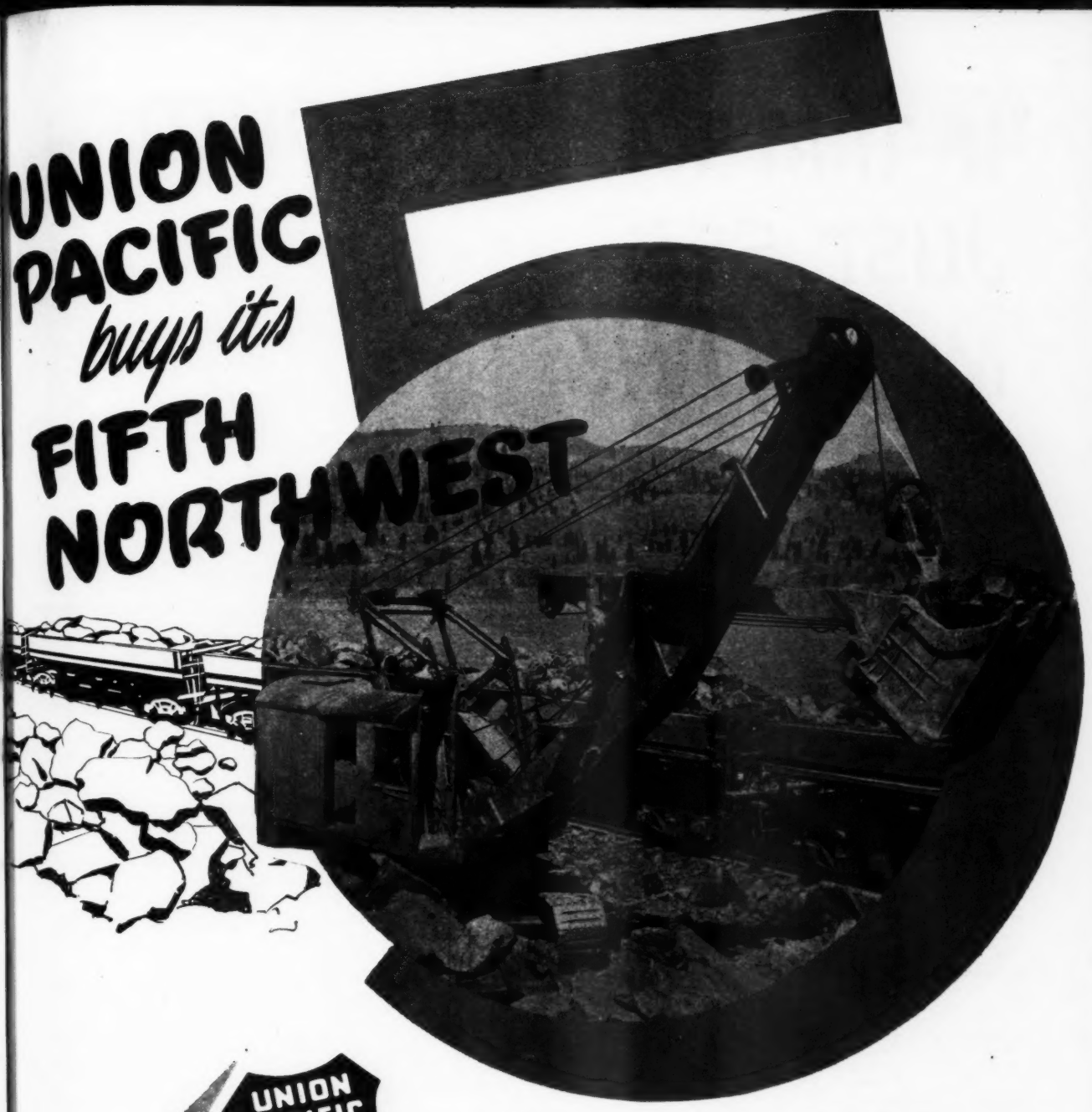

STOCK RAIL SECURELY CLAMPED DOWN ON RIDGE – SEE SECTION A-A AND B-B
TWO TIE JOINT PLATE WITH MILLED RAIL SEAT
TURNOUT PLATES WITH MILLED RAIL SEATS
STOCK RAILS AND CLOSURE RAILS CANTED 1-IN-40
"SAMSON" UNDERCUT STOCK RAIL SHOWING THE INCREASED THICKNESS OF SWITCH POINT
MORDEN "SECURITY" ADJ. RAIL BRACE
HIGH STOP WELDED TO PLATE SEAT
MALL ADJ. CLAMP
EXTRA THICK SOLID PLATES ARE MILLED AND MACHINED TO AN ACCURATE FIT NO WELDING
STOCK RAIL HELD DOWN ON 3½ FT. SIDE FOR FULL WIDTH OF PLATE
CANTED RAIL SEAT
SECTION-A-A
SECTION-B-B

Fig. 400

Morden Frog and Crossing Works CHICAGO, ILL.

Representatives in: CLEVELAND, OHIO; NEW ORLEANS, LA.; LOUISVILLE, KY.; ST. LOUIS, MO.; WASHINGTON, D. C.

UNION PACIFIC buys its FIFTH NORTHWEST



UNION PACIFIC THE OVERLAND ROUTE

Here is another of the many Class 1 Railroads that have proved its satisfaction in Northwest performance by a repeat order purchase of Northwest equipment.

NORTHWEST ENGINEERING CO.
1713 Steger Bldg., 28 E. Jackson Blvd.
Chicago 4, Illinois

THE ALL-PURPOSE RAILROAD MACHINE

NORTHWEST

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

Proved on the Nation's Leading Railways

"IF THAT TOP KICK COULD JUST SEE ME NOW!"

VETERANS! WHY NOT RUN YOUR OWN BUSINESS?

You can cash in on what you learned in the army about welding. Thousands of 200, 300 and 400 Ampere AC and DC Arc Welding units are surplus and available to you on veteran priority. There are large quantities of Hobarts and Lincolns, quite a few Westinghouse and fair amounts of other makes for sale now. Most of the equipment is used and in good operating condition. Best of all, it is being sold at prices you can afford in setting up your own repair shops or for contract work. Write, wire or phone the nearest War Assets Administration Regional Office below or come in and ask for the special veterans' service section.

FREE INFORMATION

For full information clip and mail this coupon to War Assets Administration:

Please send me complete information on the availability, condition and location of the following types of equipment:

☐ Hobart Arc Welders
☐ Lincoln Arc Welders
☐ Westinghouse Arc Welders
☐ Electrodes and Welding Rods

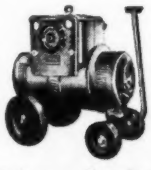
Arc Welding Equipment: AC.... DC....
Electric Motor Driven: Volts....Phase....Cycles....
Transformer Type: Volts....Phase....Cycles....

Name.....

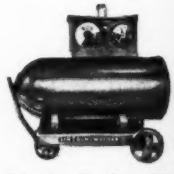
Firm.....

Address.....

City.....State.....



Hobart — Standard models of this make available in large quantities and most ratings.



Lincoln—In all models and most ratings. Hundreds in the popular 300-400 Ampere size.

EXPORTERS: Most surplus property is available to the export market. Merchandise in short supply is withheld from export, and if such items appear in this advertisement they will be so identified by an asterisk.

All arc welders are subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the material offered herein.

WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

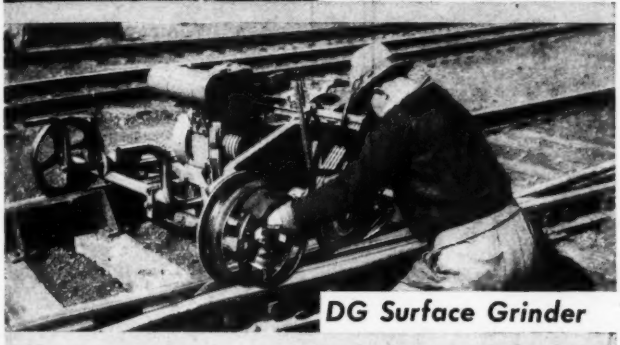
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

* 6484

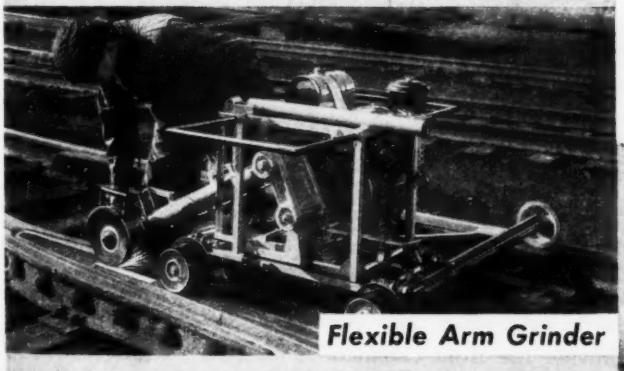
5 NORDBERG GRINDERS for

Rail — Frogs — Switches — Crossings

WG Surface Grinder



DG Surface Grinder

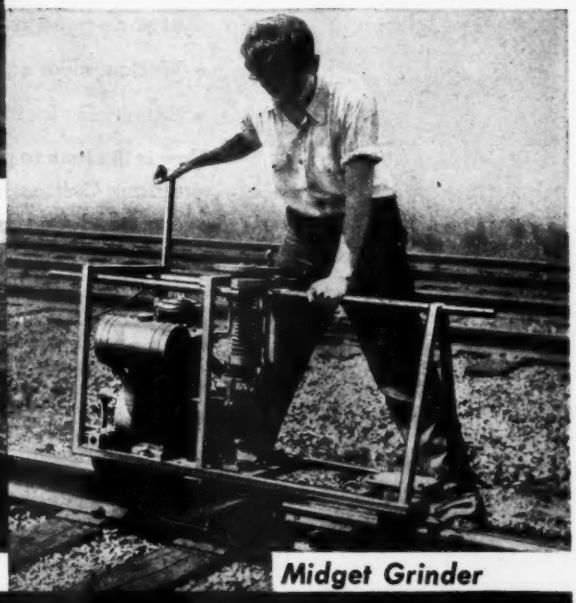


Flexible Arm Grinder

Utility Grinder

Whatever the grinding job — *surfacing rail reconditioned by welding — leveling cropped rail — taking out corrugations and wheel burns — slotting rail ends — removing flow at switches and stock rails — grinding frogs — switch points, flangeways, etc.* — there is a Nordberg Grinder that was developed to exactly meet your needs. These tools were not only designed to do a better quality of work, but afford the utmost in convenience and adaptability to the wide variety of grinding encountered in the maintenance and reconditioning of track. For your grinding needs, see what Nordberg has to offer.

NORDBERG MFG. CO.
MILWAUKEE 7, Wis.
Export Rep.—WONHAM, INC., 44 Whitehall St., New York



Midget Grinder

NORDBERG TRACK MAINTENANCE TOOLS

36 Years of Railroad Weed Control Service . . .

That's your assurance of:

- Dependable chemicals.
- Common sense analysis of your weed problem.
- Workmanlike equipment.
- Nationwide facilities.

Now is the time to plan your 1947 weed control program. Call on us to help you . . . we can recommend and provide the right chemical weed killer to suit your condition.

CHIPMAN CHEMICAL COMPANY, Inc.

Chicago, Ill. Houston, Tex. Palo Alto, Calif. Bound Brook, N. J. Portland, Ore. No. Kansas City, Mo.

Manufacturers of

ATLACIDE CHLORATE WEED KILLER and ATLAS "A" ARSENICAL

also **Chipman 2,4-D Weed Killer** and **CHLORAX Weed Killer**

"AMERICAN" LOCOMOTIVE CRANES

WON'T TEETER!

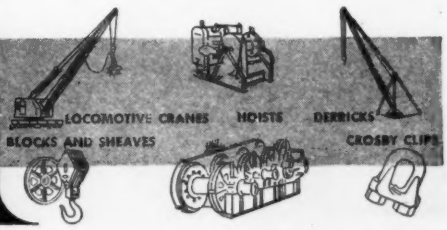
DECK TURNS ON HUGE, SNUGLY FITTING ROLLER BEARING

INTERLOCKING GIB RINGS HOLD DECK FIRMLY

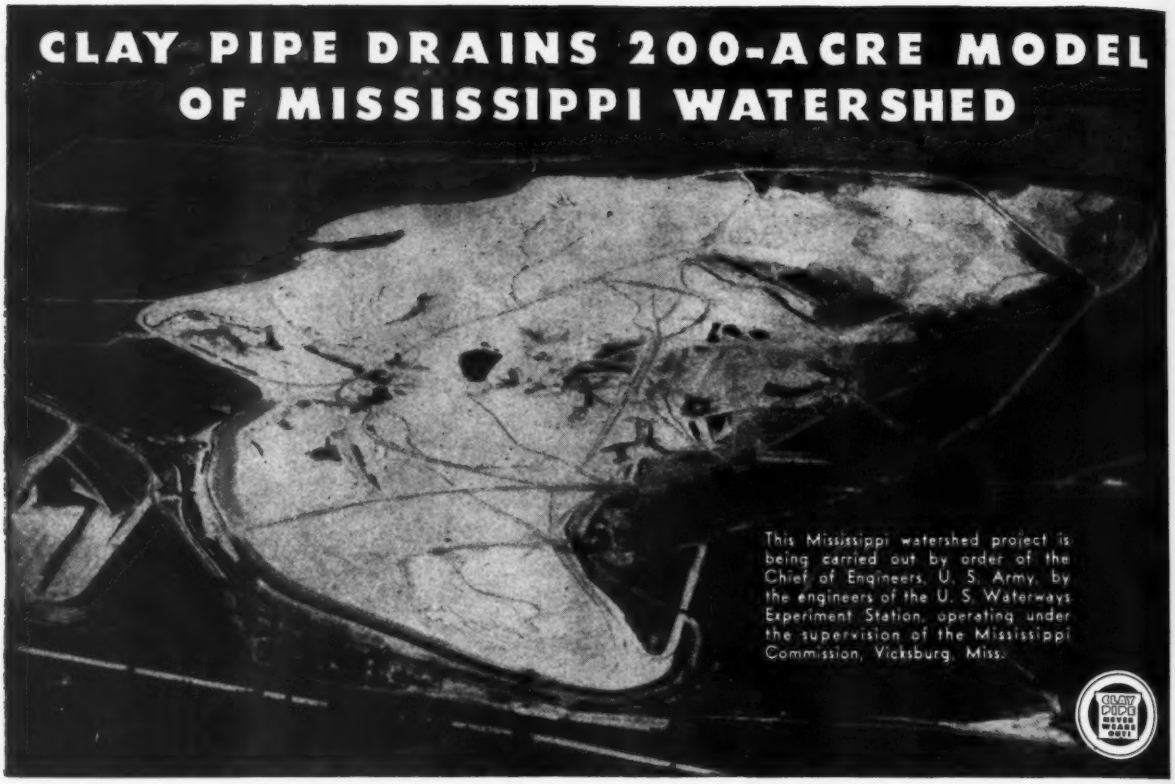
You can expect the same safe, smooth, teeter-free performance from all "American" Locomotive Cranes, whether you choose Diesel, Diesel-electric, gasoline or steam. All have the same superior turntable construction. Hoisting, slewing and drive mechanisms, however, are individually engineered for each type of power—to achieve utmost efficiency.

"American" revolving mechanisms are evidence that the best constructions possible are used *throughout* "American" Locomotive Cranes. Loads are distributed over many rollers and all around the roller paths. Full provision is made to withstand the prying effects of load lifting and the shearing effect of bumping cars. Maintenance, naturally, is minimum—another reason why it *costs less to own and operate* "American" Locomotive Cranes.

AMERICAN
HOIST & DERRICK CO.
St. Paul 1, Minnesota
CHICAGO · SAN FRANCISCO · NEW YORK



CLAY PIPE DRAINS 200-ACRE MODEL OF MISSISSIPPI WATERSHED



This Mississippi watershed project is being carried out by order of the Chief of Engineers, U. S. Army, by the engineers of the U. S. Waterways Experiment Station, operating under the supervision of the Mississippi Commission, Vicksburg, Miss.

U. S. Army engineers are using 54,000 feet of Vitrified Clay Pipe in constructing the large drainage system of the elaborate 200-acre scale model of the Mississippi Valley shown above. This model is being built to study flood control methods in the 1,244,000 square miles of the Mississippi watershed. Engineers found drainage absolutely vital to this huge scale model for two reasons: (1) the necessity for carrying off torrential rainfalls, (2) for removing water pumped into the replica to simulate flood conditions. The entire model, representing 41 per cent of the total area of the United States, will require 3 to 5 years to complete. Actual operation will be initiated as soon as a sizable section of the model is ready.

HERE IS AN EXAMPLE OF EXPERT CONSTRUCTION!

Note the narrow trenching up to the top level of the pipe . . . die-straight, accurate alignment . . . control of trench width . . . carefully-made joints. Here's a job that has been carefully engineered and carefully installed for the very best results.

ON ANY PROJECT, combine engineering "know how" with Clay Pipe, and you have an unbeatable combination for long, trouble-free service! Clay, nature's raw material, is shaped under tremendous pressure and vitrified at fusing temperatures to produce the tough, hard pipe that never wears out. Clay Pipe is impervious to acids, corrosion, crumbling and rust. It does not require periodic or frequent replacement. *When you use clay, it's down to stay!*

NATIONAL CLAY PIPE MANUFACTURERS, INC.
111 W. Washington St., Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
1105 Huntington Bank Bldg., Columbus 15, Ohio
571 Chamber of Commerce Bldg., Los Angeles 15, Calif.

C 1146 9

Airco railroad technical men have spent years on the lines of American railroads helping to find faster, better, more economical methods of performing maintenance-of-way operations with the oxyacetylene flame and arc welding.

They've carried on constant research in Airco laboratories to develop new processes and new products promoting further efficiency of maintenance-of-way welding operations.

The results of this experience are all combined in this new 32 page booklet "Efficient Maintenance-of-Way Operations with the Oxyacetylene Flame and Arc Welding." It tells—and shows with scores of pictures—how these versatile tools can be employed to do many maintenance-of-way jobs in less time, at less cost and with less effort.

It's a book you'll enjoy reading and want to keep handy for reference. Mail the coupon for your copy today. Write: Air Reduction, 60 E. 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas.

Are you doing it the most EFFICIENT WAY?

LOOK HERE FOR THE RIGHT ANSWER

AIR REDUCTION
60 E. 42nd St.
New York 17, N. Y.

REM

Send a copy of *"Efficient Maintenance-of-Way Operations with the Oxyacetylene Flame and Arc Welding"* to

Mr._____

Title_____

Road_____

Address_____

City_____ Zone____ State_____

AIRCO **AIR REDUCTION**

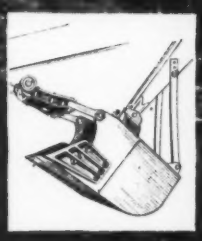
Offices in All Principal Cities

Costs Come Down Under the Airco Plan

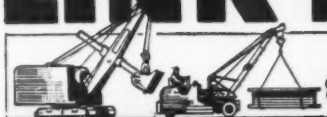
"Off-the-Track" EQUIPMENT Pays Off!

LINK-BELT SPEEDER DOES MORE WORK...
MORE KINDS OF WORK...MORE OF THE TIME!

On the line, Link-Belt Speeder crawler-mounted machines perform routine or emergency jobs with ease, speed and abundant power. Quickly convertible to shovel, crane, dragline or pile driver, their wide utility matches the endurance and trouble-free operation designed and built into them—and which railroaders especially appreciate. In yards, stores and repair shops, the wheel-mounted Cargocrane is indispensable for lifting and carrying loads up to 10 tons. 10.226



LINK-BELT SPEEDER



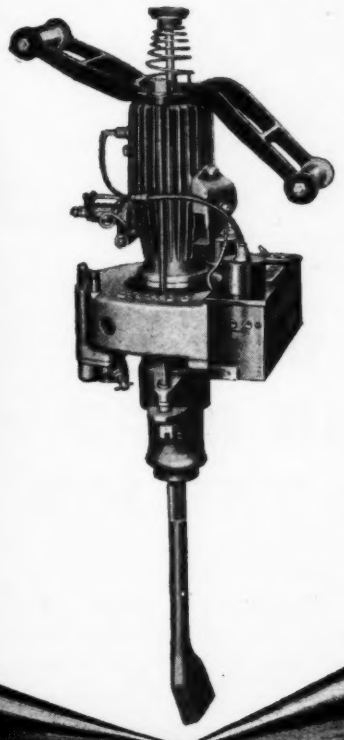
Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES

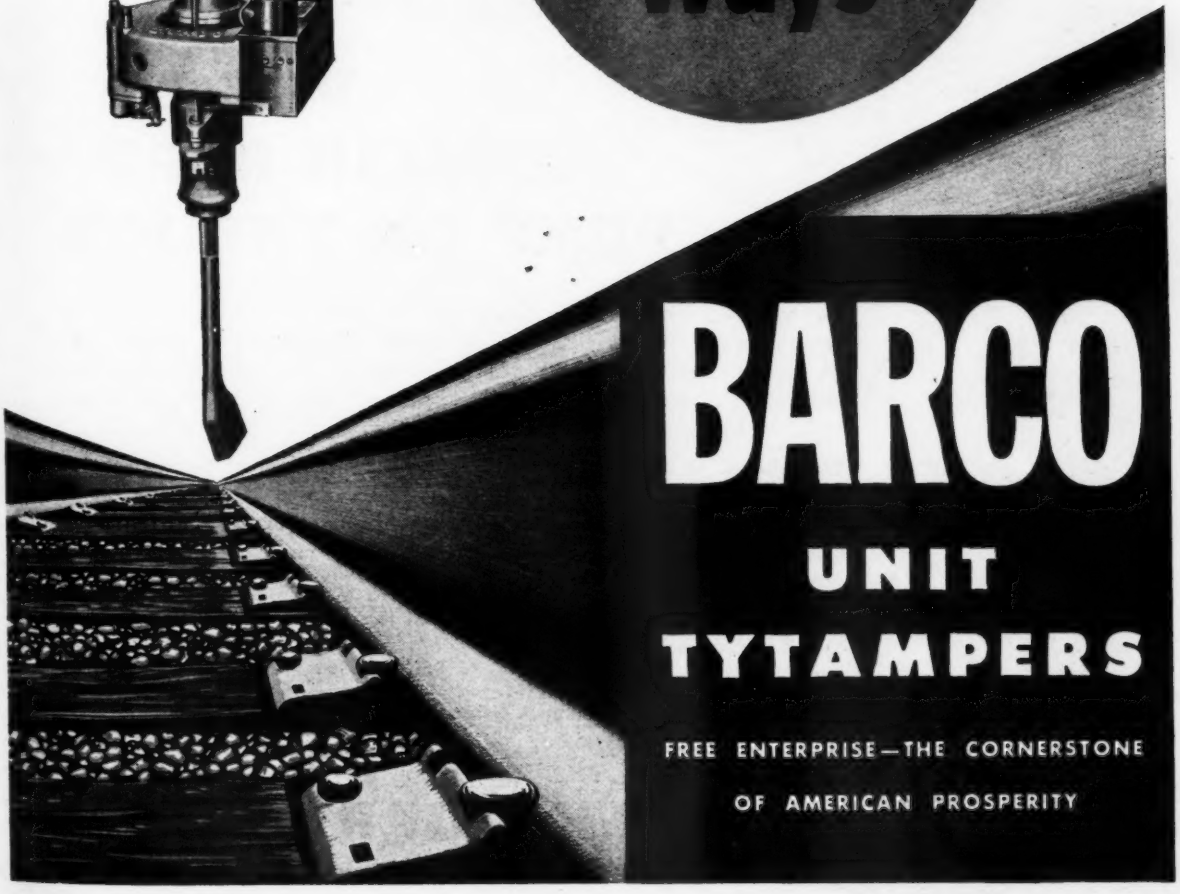
LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO 9, ILL.
(A DIVISION OF LINK-BELT COMPANY)

The Right Way

Barco Tytampers, at work on right-of-ways the country over, have proved both their efficiency and economy for spot tamping, cribbing, breaking, drilling and winter ice service. Easy to handle, self-contained, with built-in ignition, these compact workers are keeping thousands of track miles in top shape, enabling hundreds of repair crews to get more jobs done. Write for complete details. Barco Manufacturing Co., Not Inc., 1805 Winnemac Avenue, Chicago 40, Illinois In Canada: The Holden Co., Ltd., Montreal, Canada.

On Right-of-Ways



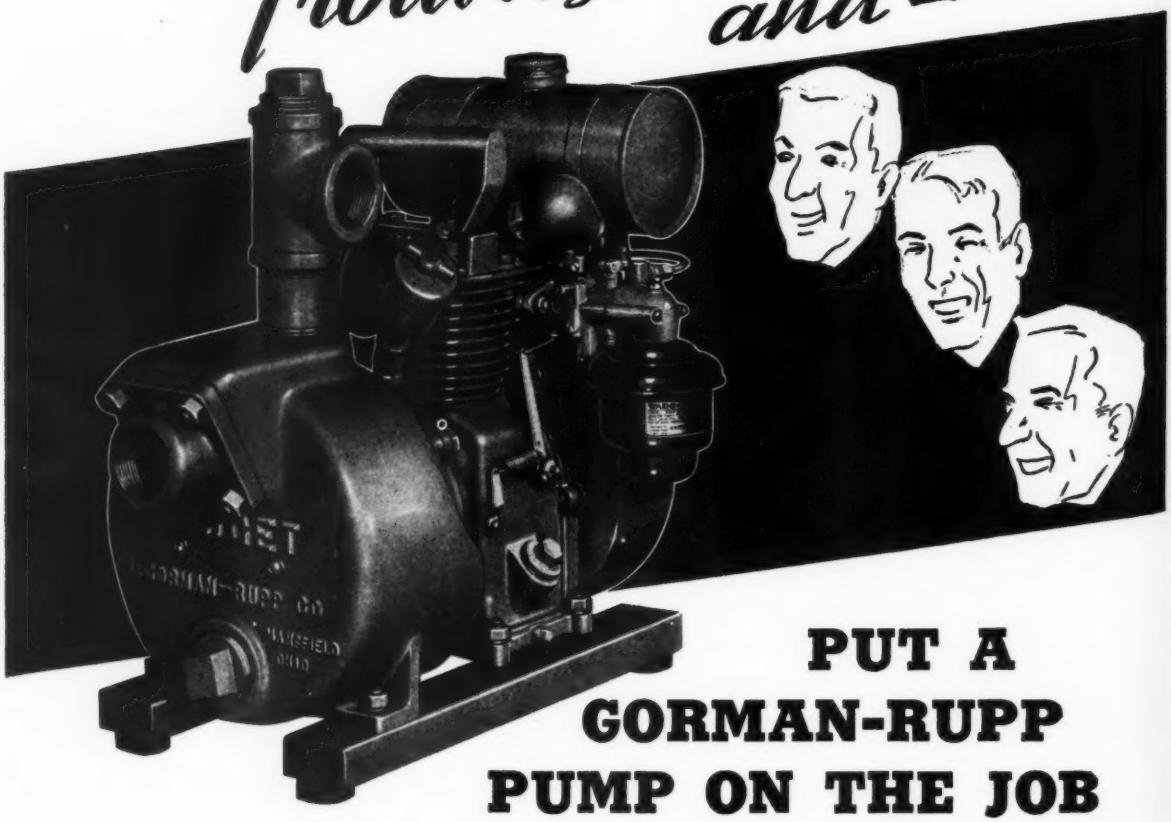


BARCO

UNIT TYTAMPERS

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

"Pack up your Troubles" and—



PUT A GORMAN-RUPP PUMP ON THE JOB

You can't go wrong with a trouble-free Gorman-Rupp self-priming, centrifugal pump. They ask no time off for rest or repairs. They will handle any muck or solids that will pass the intake strainer without damage to the pump. They are automatic self-priming; have no valves to tinker with; no by-passes to rob efficiency.

The Midget is the smallest of more than 50 models of Gorman-Rupp pumps. It weighs only 60 pounds and will handle 3000 gallons per hour against a 20 foot head and will do it for months at a time without attention. Gorman-Rupp pumps are made in any size or capacity up to 125,000 gallons per hour.

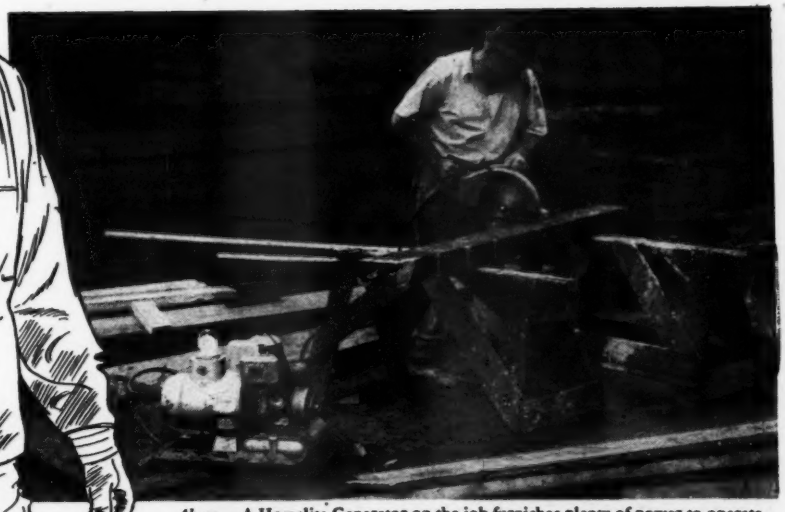
Put a Gorman-Rupp pump on your next job — give it a tough workout and if it does not out-perform any pump you have used return it at our expense and it will not cost you a cent.

Write for further information or contact your nearest distributor.

THE GORMAN-RUPP COMPANY

332 N. BOWMAN STREET • MANSFIELD, OHIO

Their Performance Speaks Louder Than Words



Above — A Homelite Generator on the job furnishes plenty of power to operate time-saving electric saws.

Below — A Homelite Pump and Generator make the right combination for speeding dewatering jobs at night.

We'd much rather show you Homelite Portable Gasoline-Engine-Driven Pumps and Generators *in action* than just talk about them. Action speaks louder than words.

So why not let us give you a free demonstration . . . any place you want it. See how fast a Homelite pumps, how quickly it primes itself, how easily it handles heavy liquids and solids. See all the cost-cutting operations you can put to good use, on day or night work with steady electric power furnished by a handy Homelite Generator.

To get such a demonstration, free from all obligations, simply write. We'll have our nearest representative get in touch with you.

Homelite
CORPORATION
Port Chester, New York
Portable Pumps Generators and Blowers
GASOLINE-ENGINE-DRIVEN

LITTLE JOBS

ARE A BIG PROBLEM

Maintaining a smooth road bed calls for a lot of spot surfacing jobs along the entire line. Little jobs, yes, but every one important and necessary if fast schedules are to be maintained.

Section gangs like the air-operated MT-3 Tie Tamper because it is more comfortably held—tamps more track with a minimum of fatigue and the men simply guide the machine as it does the work.

To furnish reliable air power for the tampers and the other air-operated track maintenance tools that are needed for all the little jobs—and the big ones, too—we offer both off-track and on-track compressors.

SEVENTY-FIFTH ANNIVERSARY

AIR TOOLS
COMPRESSORS
CONDENSERS
ROCK DRILLS
TURBO BLOWERS
CENTRIFUGAL PUMPS
OIL & GAS ENGINES

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 11-835

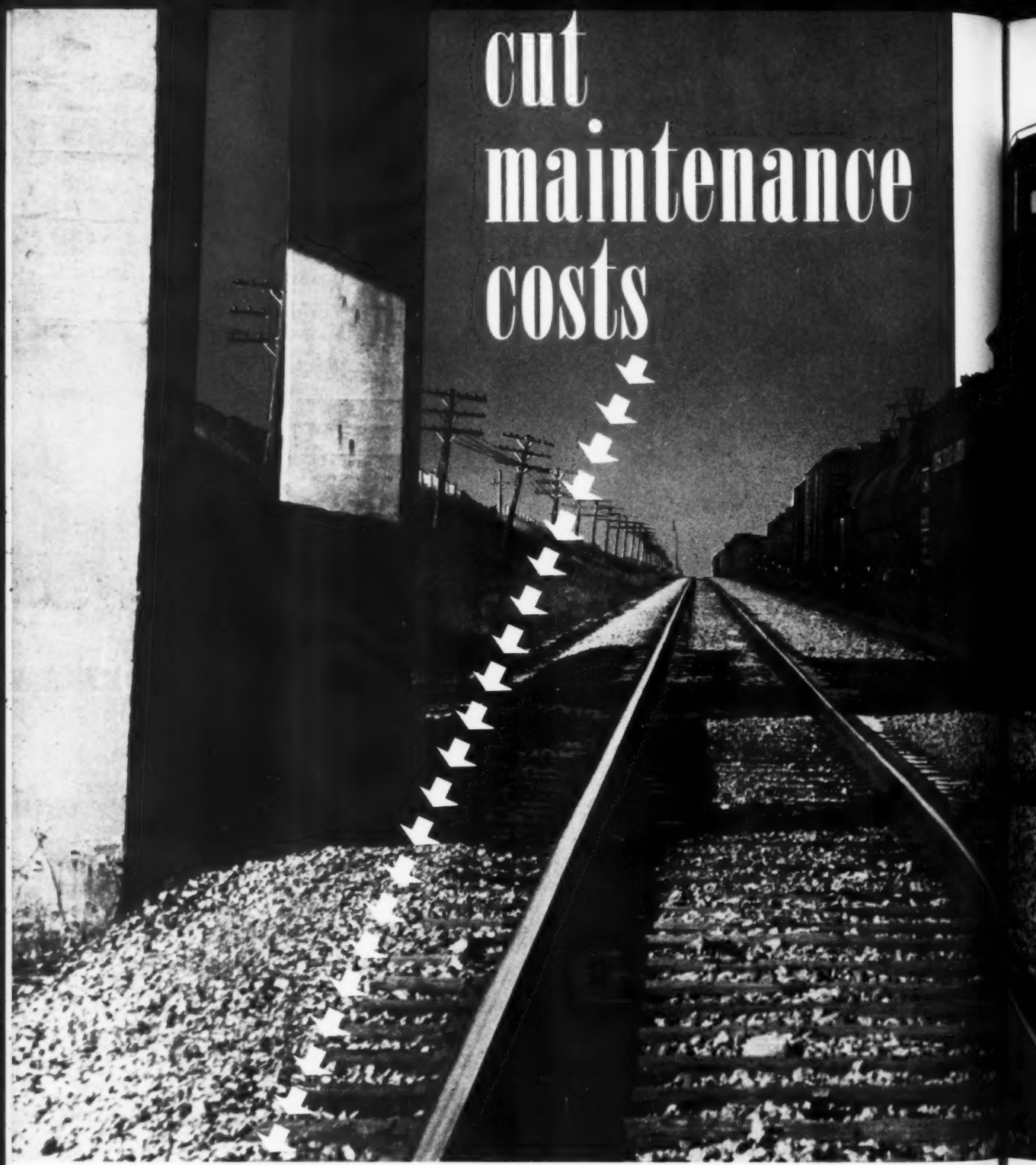
ORIGINATOR OF MECHANICAL TAMPING

by **SNOWCO**

one-spot, main line sanding unit; eight fixed outlets

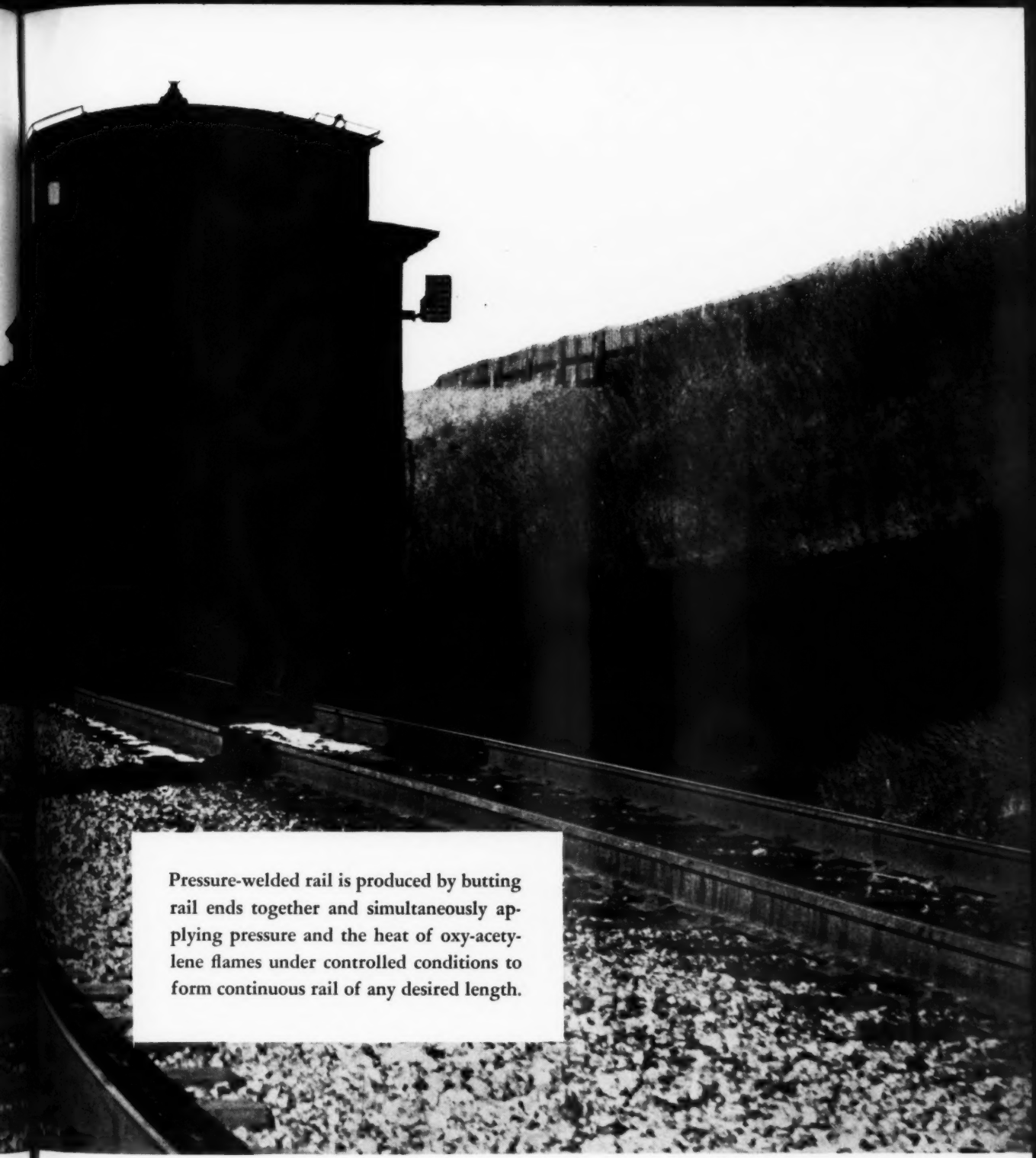
T. W. Snow Construction Co.

9 S. Clinton Street
Chicago 9, Illinois



BY OXWELD'S PRESSURE WELDING

Difficult and costly maintenance of track in cuts and similar locations is materially reduced by the use of oxy-acetylene pressure-welded continuous rail. Write for Form 6477 which describes the use of pressure-welded rail on bridges.



Pressure-welded rail is produced by butting rail ends together and simultaneously applying pressure and the heat of oxy-acetylene flames under controlled conditions to form continuous rail of any desired length.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York

OXWELD RAILROAD SERVICE

SINCE 1912 — THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

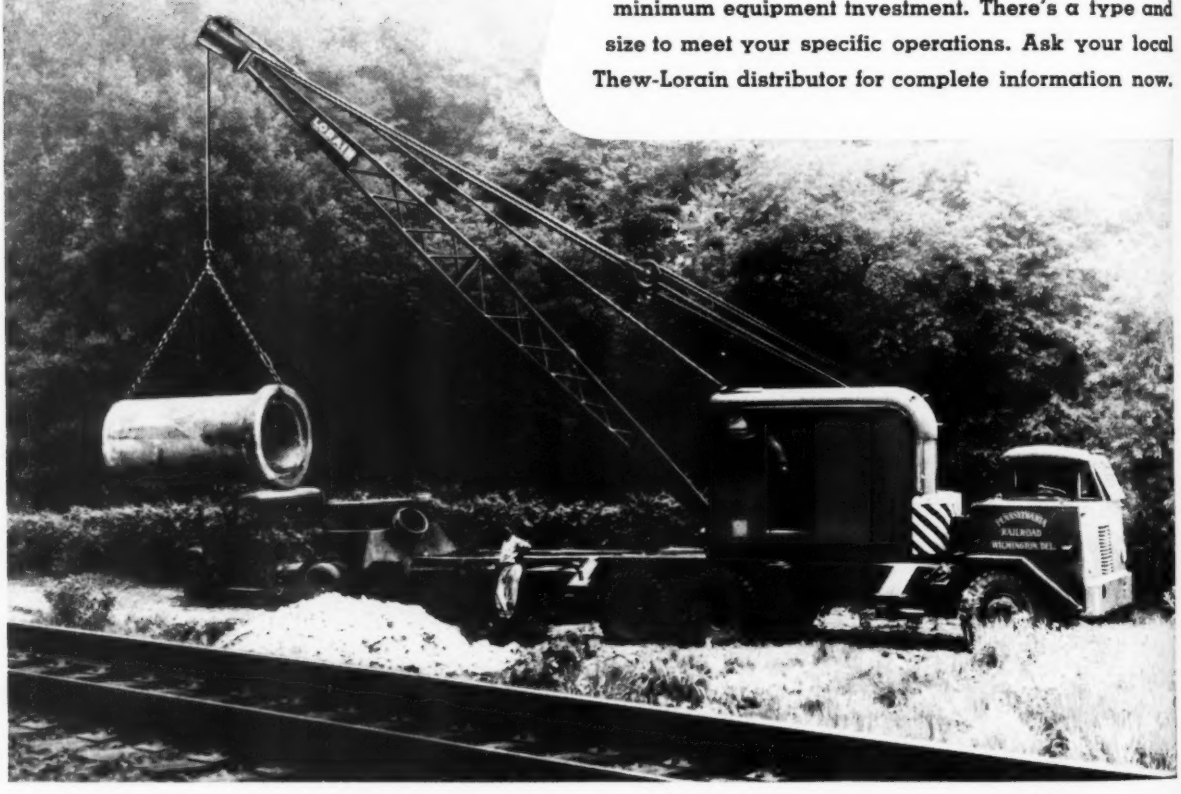
MOTO-CRANE

puts maintenance work on "Express" schedules

HERE'S how one railroad is using a Moto-Crane to meet stepped-up maintenance schedules. Excavating for this under-track drain and setting the 1½ ton sections of concrete pipe is just one type of job. As a clamshell, it is used for general ditching service. As a crane, this unit handles rails, frogs and other materials; loads and unloads air compressors for track-side operation; does wreck train duty.

Traffic and maintenance work both keep moving where a Moto-Crane is used. It works off the tracks, travels the highway between jobs at speeds up to 33 M. P. H., has ample low speed power for off-the-road going into the job.

Moto-Crane mobility will enable you to deliver "on the spot" crane, clamshell and dragline service along more miles of right-of-way with a minimum equipment investment. There's a type and size to meet your specific operations. Ask your local Thew-Lorain distributor for complete information now.



Reg. Trade Mark

thew-Lorain

THE THEW SHOVEL COMPANY
LORAIN, OHIO

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES

For Faster, Positive Driving . . .
and Removal of Nuts, Bolts and Cap Screws

A NEW LIGHTWEIGHT PNEUMATIC REVERSIBLE IMPACT WRENCH

BY Thor

Smallest, Most Powerful
Tool of Its Class . . .

A radically new direct-impact mechanism—*exclusive in the new Thor Impact Wrench*—delivers a heavier torque blow *without torque reaction to fatigue the operator.* This is accomplished by applying the power of the motor POSITIVELY to the impact spindle through an anvil. A short, rigid shank on the impact spindle delivers full and efficient transmission of the blow—close to the work and at a larger radius to the spindle center for more power and smoother operation. This new impact wrench is easier to handle because it's lighter and more compact—only 3¾ pounds.

Nuts up to ⅜" thread size can be driven *tighter* . . . or tight nuts removed *faster.* Simplified mechanism eliminates many moving parts . . . assures long tool life and lower maintenance. *Prove its advantages—ask your nearest Thor branch or representative for an early demonstration.*

OPTIONAL LEVER THROTTLE
(Size No. 6-L illustrated at left)

NEW SIZES COMING!
More Thor Impact Wrenches will soon be available—in ¼", 5/16", ¾" and 1¼" capacities.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Boulevard, Chicago 6, Illinois
Birmingham Boston Buffalo Cleveland Detroit Los Angeles Milwaukee New York Philadelphia
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Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

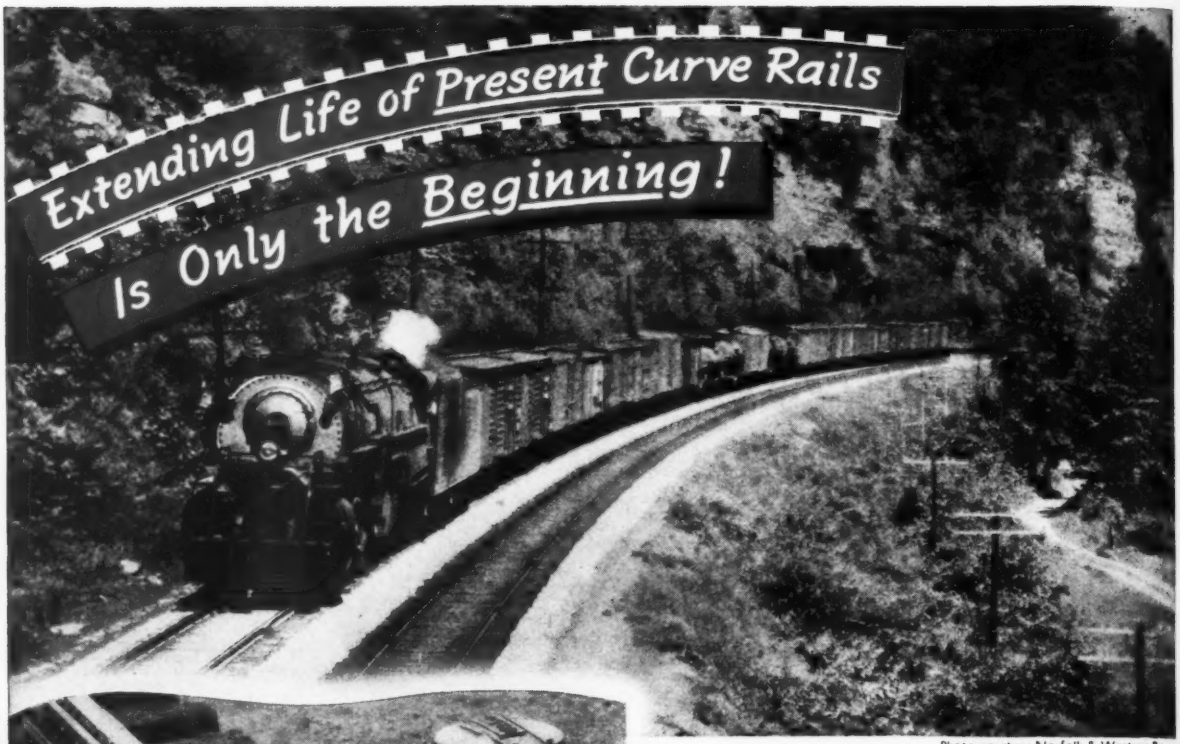


Photo courtesy Norfolk & Western Ry.

Each MECO Lubricator Protects a Number of Curves

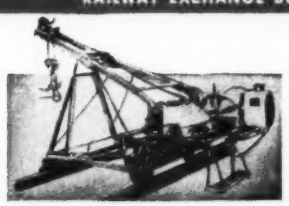
MECO Lubrication

MECO Lubrication economy *begins* with your present curve rails — but the MECO Lubricator *stays* on the job when curves are relaid with new rail, to double and quadruple their life, too! MECO Lubrication checks the friction of today's tonnage against curves — greatly reduces wear on wheel flanges and rail — permits higher speeds, with safety — pays dividends for many years on curves subjected to heavy traffic.

Maintenance Equipment Company

RAILWAY EXCHANGE BUILDING • CHICAGO 4, ILLINOIS

1977



Power Rail Layer Requires No Train Orders

Mack Reversible Switch Point Protectors Make switch rails last 8 to 10 times longer

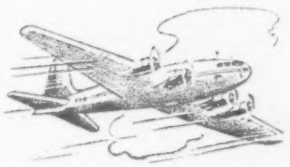
OFF-TRACK EQUIPMENT
Helps Meet The New Challenge

Railroads hang out the "Welcome" sign to competition . . . for it is the life-blood of America. Our country thrives because of it!

But its demands are strict. Every way to improve service, yet reduce cost must be investigated.

You who handle right-of-way construction and maintenance can aid your road by calling management's attention to the many ways it can save time and money with off-track equipment. It works free of the tracks, there is no interference with traffic . . . and no matter where there is a job to be done, it's a simple matter to truck overland or ship the machines by flat car. On the job they quickly handle ditching, sloping, clearing . . . repair washins and washouts . . . remove wreckage and straighten tracks at lowest possible cost.

But you will want to know the entire story. Let us put you in contact with your Allis-Chalmers dealer . . . NOW! Help your road meet the new challenge!



Here's the most economical way to construct ditches and build up slopes. Simply bulldoze the material with a fast-working Allis-Chalmers 2-Cycle Diesel Tractor. No interference with traffic either.

Where material is to be dug, hauled over a distance and dumped on a slope . . . use the A-C 2-Cycle Diesel Tractor and rear-dump 2-wheel scraper. A handy, low cost outfit for many jobs.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

OFF-TRACK EQUIPMENT FOR EVERY NEED

2-CYCLE DIESEL TRACK-TYPE TRACTORS • GASOLINE WHEEL TRACTORS • POWER UNITS • MOWERS • Plus ALLIED ROAD MACHINERY — Bulldozers, 2- or 4-wheel Scrapers, Tractor Cranes, Rippers, Tractor Shovels, Snow Plows, Sheepfoot Rollers, other units to meet your requirements.

For Durable, Comfortable Station Floors and Platforms...

...SPECIFY COLD-LAID MASTIC!

That's the floor for you . . . for new construction or for complete reflooring over wood, steel or concrete. Why? Its many advantages have been proven over the years.

- It's tough. A cold-laid Mastic Floor made with Flintkote Flooring Emulsion has high point-load resistance. Takes heavy impact without chipping.
- It's resilient. Heals itself of minor scars and cuts. Absorbs shock and vibration. Makes a comfortable walking surface and withstands heavy trucking.
- It's clean and quiet. The "cushion" effect absorbs traffic noise. It's dustless . . . easy to keep clean.
- It's easily applied. Cold-laid, in a matter of hours . . . saves time and money.
- It's time saving. You can apply a Mastic Floor made with Flintkote Flooring Emulsion quickly and easily and open to traffic within 24 to 48 hours.

See what we mean? Write today for full information on cold laid Mastic Floors made with Flintkote Flooring Emulsions.

Flintkote-Products for Industry

THE FLINTKOTE COMPANY · INDUSTRIAL PRODUCTS DIVISION

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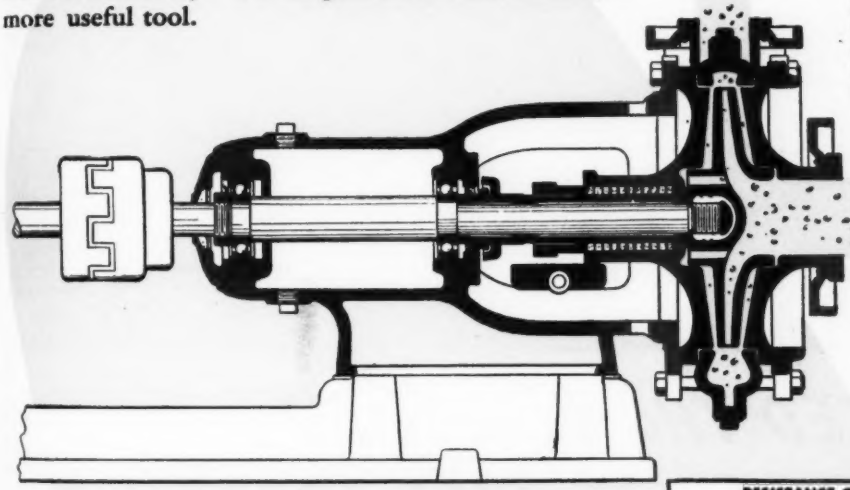
NEW BJ CORROSIRON* ACID RESISTING PUMPS

A new line of centrifugal pumps, remarkably resistant to the corrosive action of most acids.

Pumping highly corrosive liquids is a tough job, a job that requires rugged pumping equipment of a specialized nature. And the new BJ Corrosiron Acid Pumps meet the requirements with new maximums of usefulness and economy. We are pleased to offer industry a more useful tool.

All pump parts that contact pumped liquid are of Corrosiron, as indicated by solid black cross-section areas in illustration. BJ Corrosiron Acid Pumps are of horizontal, single stage, end suction, closed impeller construction, with heavy ball-bearing bracket mounted on cast iron baseplate. Furnished with flexible coupling for direct connection to driver. Sizes: 1½" to 3"; Capacities: 30 to 425 gpm; Pumping Heads: 20 to 140 feet; Speeds: 1150, 1450 and 1750 rpm.



*Registered Trade Mark of Pacific Foundry Company, Ltd.

UNUSUAL CORROSION AND ABRASION RESISTANCE

Corrosiron is a high silicon iron remarkably resistant to the corrosive action of most acids (a greater number of acids, and in greater degree, than any other commercial alloy). Furthermore, it is extremely abrasion resistant, having a hardness of 300 Brinnell. Is unexcelled for handling corrosive liquids carrying abrasive solids.

Corrosiron resists the corrosive action of sulphuric, nitric, and acetic acids at all concentrations and temperatures. It resists the corrosive action of many other acids to a degree dependent upon concentration and temperature. Test figures shown at right are interesting. The figures are from government, university, and commercial testing laboratories.

Corrosiron also resists the corrosive action of hydrofluoric, sulphurous, and hydrochloric where low concentrations are encountered below 5 or 10 percent.

INGENIOUS ENGINEERING

The brittleness and low tensile strength characteristics of high silicon irons pose unusual problems in engineering a centrifugal pump. But special care and the ingenious application of many years of experience provide the solution. These new BJ Corrosiron Acid Pumps are engineered for years of heavy-duty, trouble-free operation.

We invite inquiries about the application of BJ Corrosiron Acid Pumps to the pumping of corrosive liquids.

RESISTANCE OF CORROSIRON TO CHEMICALS
(STILL SOLUTIONS AT ROOM TEMPERATURE)

CONCENTRATION	CHEMICAL	LOSS, DEPTH IN. PER YEAR	CONCENTRATION	CHEMICAL	LOSS, DEPTH IN. PER YEAR
80%	Acetic Acid	.0000048	7.9%	Oxalic Acid	.0000234
27%	Ammonium Chloride	.0000183	Comm'l	Oleic Acid	None
25%	Antimonous Chloride	.000037	10%	Phosphoric Acid	.0000232
5%	Benzoic Acid	.0000078	25%	Phosphoric Acid	.0000116
1½%	Bleaching Powder	.0000073	67%	Phosphoric Acid	.000019
25%	Citric Acid	.000135	31%	Pyrogallic Acid	.000014
25%	Copper Sulphate	.0000102	1.39%	Picric Acid	.0000051
48%	Ferric Chloride	.00414	9.1%	Picric Acid	.0000051
50%	Ferric Sulphate	.0000075	10.75%	Potash Alum	.0000115
25%	Formic Acid	.00029	25%	Potassium Bromide	.00029
5%	Hydrochloric Acid	.00145	19.4%	Sodium Carbonate	.000052
25%	Lactic Acid	.000048	25%	Sodium Chloride	.000285
25%	Magnesium Chloride	.000035	18%	Sodium Hydroxide	.000022
25%	Monochloracetic Acid	.000052	18%	Stannous Chloride	.00000165
10%	Nitric Acid	None	25%	Sulphuric Acid	.0000173
25%	Nitric Acid	None	95%	Sulphuric Acid	.0000208
70%	Nitric Acid	None	20%	Tartaric Acid	.000036
2.1%	Oxalic Acid	.0000306	20%	Zinc Chloride	.0000175

Byron Jackson Co.

LOS ANGELES 54, CALIFORNIA

Offices in Principal Cities

THE LIMITED THUNDERS BY
ON SAFE TRACK

The consistently high speeds and terrific loads of American railroad trains are made possible by *safe* track; track that is maintained at a constant high level of efficiency by frequent inspection and regular upkeep.

With modern Timken Bearing Equipped section motor cars helping them, roadmasters are doing a better track job than ever before — and track is *safer*. Inspection crews and repair gangs get around faster — cover more mileage — catch bad spots before they have a chance to become dangerous.

Timken Tapered Roller Bearings keep cars out of the repair shop by protecting them against friction; wear; radial, thrust and combined loads; and misalignment. Wheels and axles last longer; lubrication is simpler.

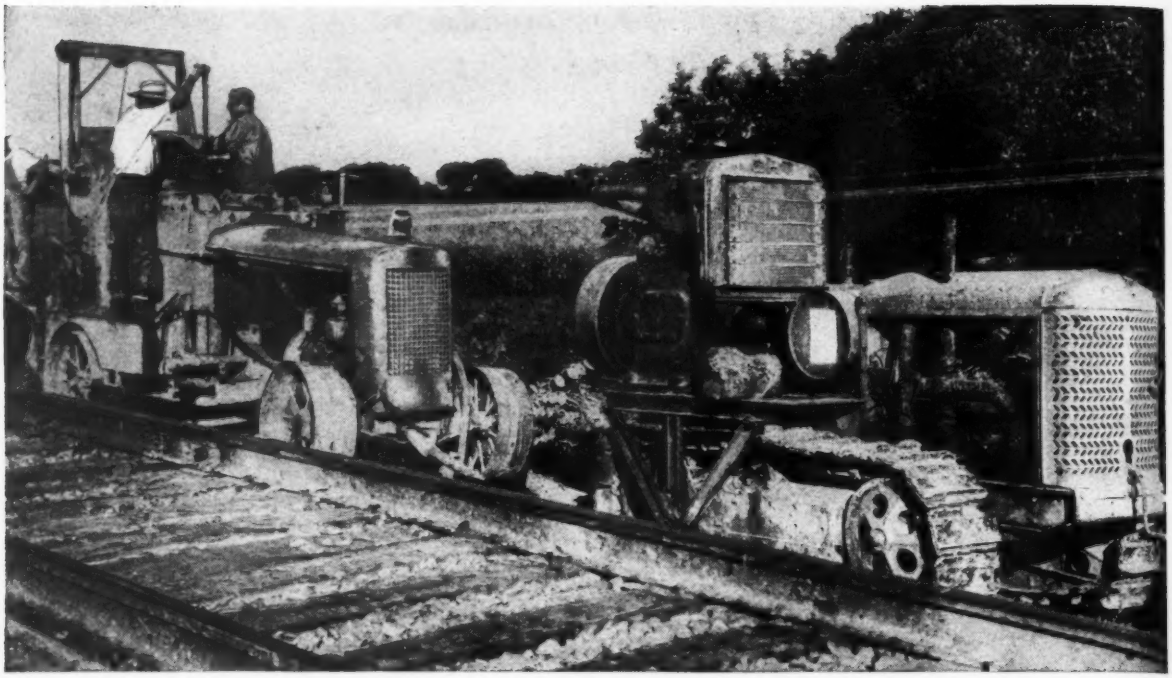
Make sure your new motor cars have Timken Bearings — with the trade-mark "TIMKEN" on every cup and cone. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
RAILWAY ROLLER BEARINGS

Pay dirt... from your roadbed. With the McWilliams "Mole" Ballast Cleaner you don't have to prospect for proper roadbed maintenance. You can stake your claim on a "Mole" and be sure that you have the most economical and efficient method of cleaning cinders and dirt from your track ballast—a necessity in these days of fast schedules and heavy loads. The McWilliams "Mole" is available in intertrack and border models. Write today for complete information.

RAILWAY MAINTENANCE CORP.

PITTSBURGH 30, PENNSYLVANIA



ASPHALT-CEMENT PRESSURE GROUTING...

the *BEST* method of roadbed stabilization

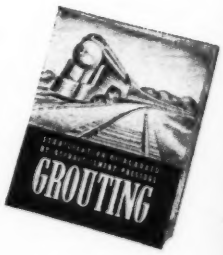
DURING the past ten years, asphalt-cement pressure grouting has emerged as the best way to stabilize roadbed. It costs less, lasts longer, and is more easily and quickly accomplished than any other method . . . and these benefits are increased when *Texaco No. 24 Emulsified Asphalt* is the asphalt used. Experience has shown it to have many advantages over ordinary asphalt.

Texaco No. 24 Emulsified Asphalt was developed especially for grouting. It promotes easier flow, and assures better penetration and seal . . . thus permitting use of leaner, more economical mixtures. In addition, it helps waterproof the soil and keep it resilient and stable.

Savings of as much as 80% in maintenance are reported by railroads using this method of roadbed stabilization. At the same time, initial costs have been much lower . . . and the work is done without interrupting traffic.

For complete information on asphalt-cement pressure grouting — methods, costs, results—call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division*, 135 East 42nd Street, New York 17, N. Y.

NEW YORK ★ CHICAGO ★ SAN FRANCISCO ★ ST. PAUL ★ ST. LOUIS ★ ATLANTA



16-page, illustrated book outlines a practical working set-up for asphalt-cement pressure grouting, shows costs and benefits secured by a leading railroad. Send for your copy.

TEXACO

TEXACO Emulsified Asphalt

FOR GROUTING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—CBS

BUDA POWER Track D

. . . ALL THE FEATURES RAILROAD MEN WANT

Easy to Use . . .

- **FAST**—*Drills holes in 30 seconds!*
- **COMPACT and LIGHT**—*Weighs only 130 lbs.*
- **ONE MAN OPERATION**—*Easily set up.*
- **SAFE and ACCURATE**—*Fast, precision adjustment.*
- **PROVED IN SERVICE**—*One railroad saved over $600.00 in one month's operation.*

• *WRITE FOR NEW BULLETIN 1233* •

Drills Between Narrow Rail Sections near Switches

BUDA CHORE BOY

BUDA

15403 Commercial Ave.
HARVEY (Chicago Suburb) **ILLINOIS**

BUDA JACKS

ESCO

TRACK WALKING SHOES and WING-DOZER

...the new system for maintaining tracks

It is no longer necessary to tie up a railroad locomotive for track construction or maintenance. *ESCO* track walking shoes and wingdozer make it possible for a tractor to do this work faster, cheaper, with less interruption to train schedules.

ESCO track walking shoes and wingdozer may be fitted to any crawler-type tractor with treads of 50 to 66 inches center to center, including "Caterpillar" D6, Allis-Chalmers HD10, Cletrac 55, International TD18 and TD14. Thus equipped, the tractor can mount the rails where its tremendous traction and power make it ideal for grading, spreading ballast, skeletonizing, spotting cars and hauling equipment. While operating off the track, the tractor can do any of its normal jobs.

There's no running for a side track when a train comes through. The tractor simply runs off the track, and moves back on after the train has passed. On one mainline job, 20 trains passed every day, but the work was finished on schedule.

ESCO catalog number 153 contains full information and description of track walking shoes and wingdozer. Ask your nearest ESCO representative for a copy (free, of course), or write direct to us.

ELECTRIC STEEL FOUNDRY SPECIALISTS IN APPLIED METALLURGY

2141 N. W. 25th AVENUE, PORTLAND 10, OREGON

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EUGENE, ORE. — 1991 Sixth Ave., W. • Phone 5012

IN CANADA—ESCO LIMITED, 1084 Homer St., Vancouver, B. C. Telephone Marine 2343

Red Lead "Soaps"

help make Paint Film Tough...Flexible...Water-Resistant

While maintenance engineers know, by long experience, that Red Lead helps *make metal last* . . . and widely accept it as the standard metal protective paint . . . it remained for modern science to show exactly *why* Red Lead so effectively inhibits rust.

One of the important reasons is Red Lead's ability to react with the vehicle, and produce unique lead "soaps."

These soaps grow to form a tough, impervious, intermeshing matrix within the paint film, as shown in the photomicrograph at right.

The soap formations increase Red Lead's protective power in several ways. For one thing, they *mechanically* reinforce and toughen the paint film.

At the same time they contribute all-important flexibility, allowing movement all along their soft, intertwining projections. This helps prevent the ruptures to which a hard unyielding film is subject.

Moreover, lead soaps slowly form primarily in the dry paint film as it ages. This is where the soap formations impart their greatest benefits. When a paint film weathers and ages, decomposition products of the vehicle are formed. Red Lead's ability to slowly combine with these decomposition products actually enhances the life of the paint film. Red Lead's slow rate of reaction means the film age-hardens at a slower rate. It thus retains a high degree of flexibility, a great factor in its lasting adhesion.

And again, the very structural formation of the soaps, with their dense, impermeable matrix of interwoven fibres, helps to restrict the passage of moisture through the paint film. Metal cannot rust without the presence of moisture.

Specify RED LEAD for ALL Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal if it contains Red Lead.

***This photomicrograph** shows the distinctive lead soap formations resulting from Red Lead's reaction with the vehicle. Note how the rod-like projections, radiating from central cores, spread out and intermesh. This makes a strong, flexible, interwoven structure, just as individual fibres in a piece of cloth are woven to make the cloth strong and durable. This type of soap formation is unique with lead paint films.*

***Here you see** the standard apparatus used for measuring the water permeability of paint films.*

With this equipment a measure of the amount of water that passes through a unit of film is obtained.

Experiments show that a straight linseed oil film allows three times as much water to pass through the film as when the same film is pigmented with Red Lead . . . illustrating once more the beneficial protective action of Red Lead and Red Lead "soaps."

Write for New Booklet—"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6, (National Lead Co. of Mass.); Philadelphia 7, (John T. Lewis & Bros. Co.); Pittsburgh 30, (National Lead Co. of Pa.); Charleston 25, W. Va., (Evans Lead Division.)

Dutch Boy
Reg. U. S. Pat. Off.
Red Lead

TOURNAPULLS help W&LE

Heap-loaded Tournapull pulls up 20% grade out of new channel

To accommodate heavy traffic on line between Dillonvale and Rayland, Ohio, the Wheeling & Lake Erie R. R. is changing Short Creek Channel, building new grade to eliminate 7 bridges on a 3-mile stretch.

Wheeling Engineering & Equipment, Inc., Cleveland contractors, use 2 Tournapulls to move 200,000 yards on this project. New creek channel is being dug 8 to 40′ deep and will be 75′ wide. Excavated material is used to build 25′ fill, with 20′ top, for new railroad grade.

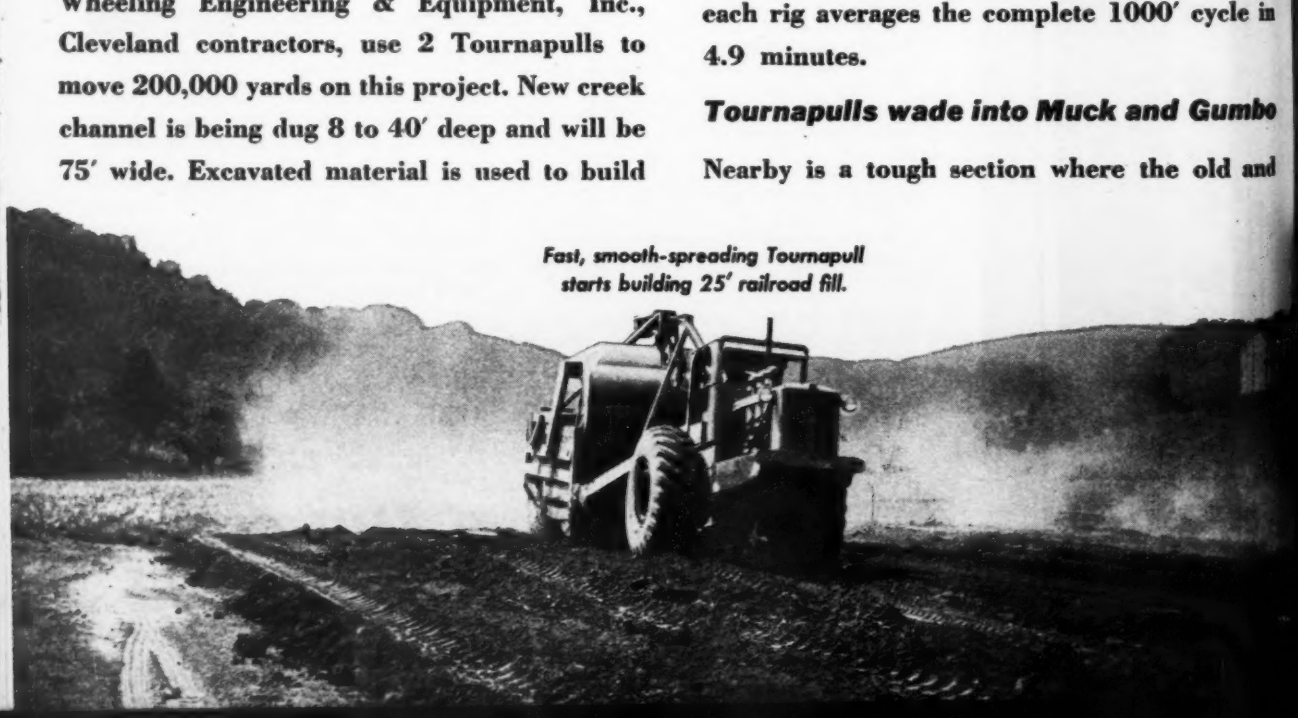
12 trips per hour on 1000′ round trip

Tournapulls are operating in all sorts of materials . . . gravel, muck, stone, quicksand, mud and top soil. On part of the job they have good digging. In common earth and sandy clay, on 150′ haul, but with 850′ return trip, each rig averages the complete 1000′ cycle in 4.9 minutes.

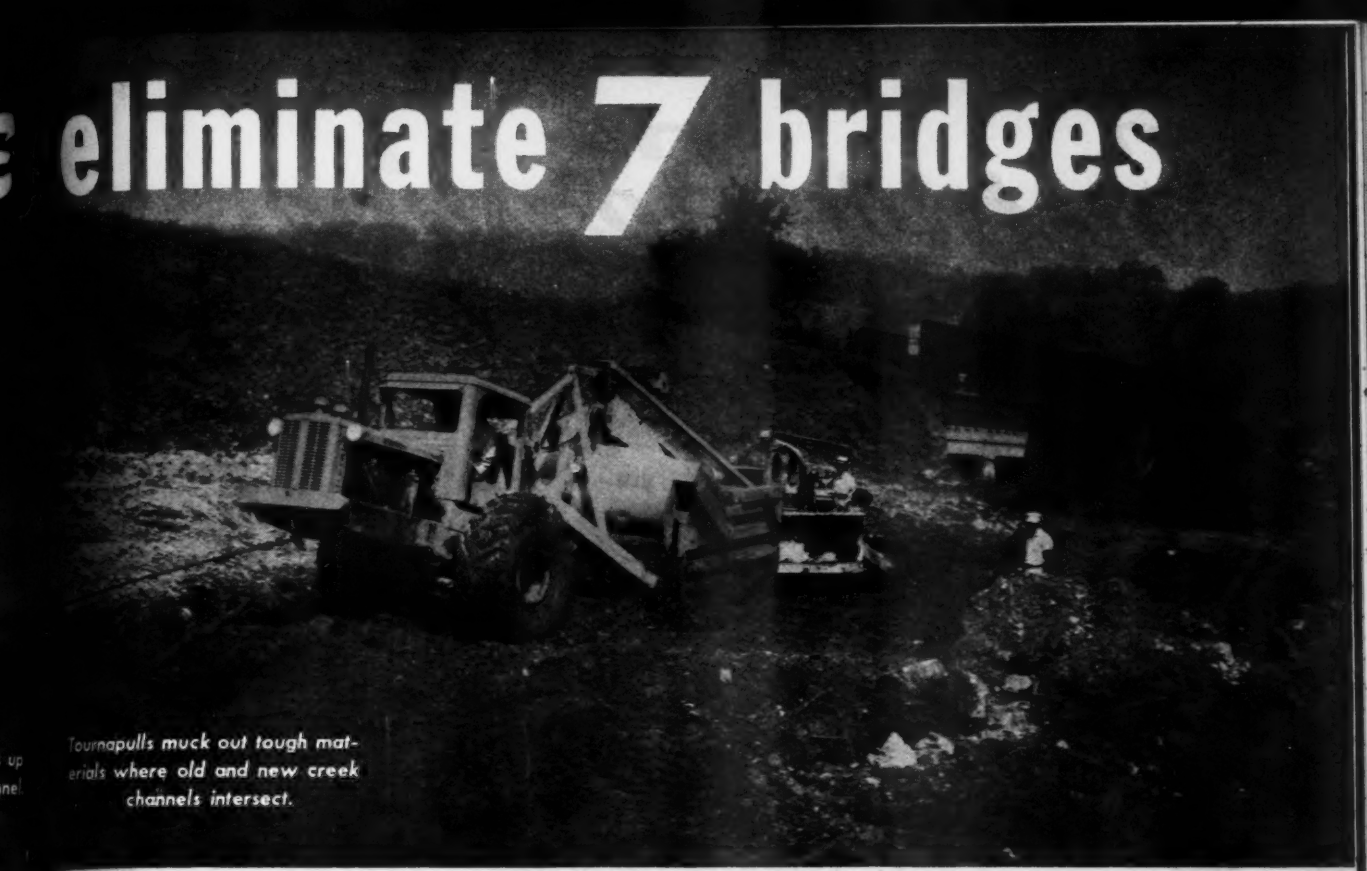
Tournapulls wade into Muck and Gumbo

Nearby is a tough section where the old and

Fast, smooth-spreading Tournapull starts building 25′ railroad fill.



eliminate 7 bridges



Tournapulls muck out tough materials where old and new creek channels intersect.

new creek channels intersect. Here the Tournapulls are working hub-deep in muck and gumbo throughout the loading operation. Due to close quarters, the Tournapulls drive in, turn in a very short radius, align themselves for push and snatch loading. Hauling out of the channel, the big-tired rigs pull loaded up 150' of 20% grade.

In both good and bad conditions, the Tournapulls are helping to keep the job ahead of schedule.

LET Check with your LeTourneau Railroad Distributor regarding savings possible with off-track Tournapulls on your construction and maintenance work. He will be glad to give you production estimates on your dirt-moving, cooperate in laying out your jobs for most efficient performance, place you in touch with dependable Tournapull contractors for your construction projects. Write for his name if you are not already acquainted.

Tournapull — Trade Mark Reg. U. S. Pat. Off. 1812

LETOURNEAU
PEORIA, ILLINOIS

JOB-PROVED
Over 4,500 Built and Shipped

TOURNAPULLS

Super Service

ON ALL TYPES OF JOBS!

½ and ¾ Yard EXCAVATORS

5 and 10 TON CRANES

Every UNIT is FULLY CONVERTIBLE

Regardless of whether your job calls for a shovel, clamshell, magnet, dragline, trenchoe, grapple or backfiller, a UNIT machine easily "fills the bill"! For UNIT is convertible to ANY attachment and gives an excellent account of itself on ALL types of service. The change from one attachment to the other can easily and quickly be made on the job, by any ordinary mechanic. UNIT exclusive features include: Automatic traction brakes... Disc type clutches... One-piece cast gear case and above all, UNIT's safety-promoting FULL VISION CAB.

CONTACT FACTORY DIRECT FOR PRICE AND DELIVERY

UNIT CRANE & SHOVEL CORP. 6403 WEST BURNHAM STREET MILWAUKEE 14, WIS., U.S.A.

SEALTITE FASTENERS

Double-Life

SEALED-TITE IN ZINC

All Sealtite products are offered in our thick, double-life, hot dipped galvanized finish. As the name implies, the service life of the bolt is lengthened saving replacement costs and assuring freedom from fastener corrosion. Actual experience tests prove the economy of using Double-Life Sealtite Products.

★ ★ ★

SEALTITE GUARD RAIL BOLT

A forged square nut and ribbing bolt that permits one man installation. The four fins anchor solidly into the wood preventing the bolt from turning. The large head protects the wood and bolt shank against water seepage and consequent damage. No counterboring is necessary. No projections on head, thus eliminating possible damage to structures, moving trains, boats or vehicles. The Sealtite Washer Nut eliminates the handling of an extra part and has the bearing surface of a standard washer and sufficient strength to break the bolt.

SEALTITE TIMBER BOLT

This single piece forged bolt has a large forged head which replaces the standard machine bolt with a washer. The protected fins add extra strength to the wood head which is large enough to completely cover and protect the bolt hole. This prevents moisture seepage and consequent damage by corrosion or wood rot.

SEALTITE LAG SCREW

Another forged one piece bolt and washer which saves time and money by doing the job of the ordinary lag screw and separate washer. Note the plastic point for easy starting, the square pressed shank head which give a perfect gripping surface for screw wrenches.

LEWIS BOLT & NUT COMPANY, 504 Malcolm Ave. S.E., Minneapolis, Minn.

Designed and Engineered

FOR RAILWAY USE

COMPARISON PROVES SUPERIORI F

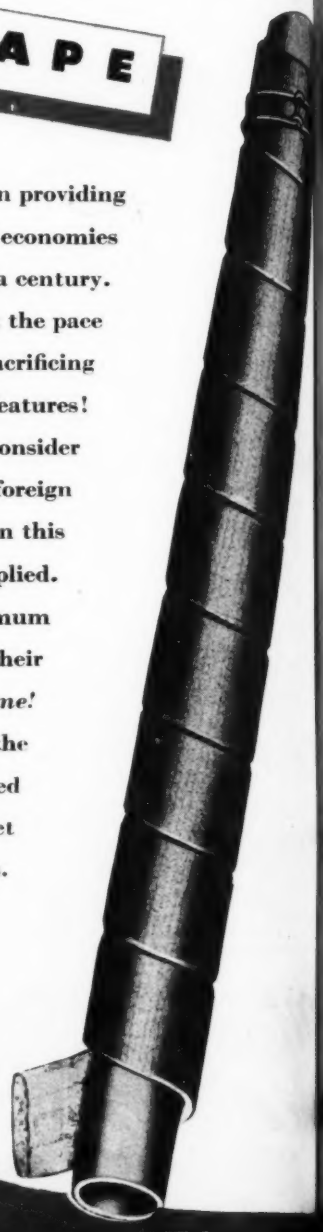
ONLY INSUT ND
CAN GIVE YOU TH S

INSUTAPE

Insutape steam pipe insulation has been providing the nation's railroads with fuel economies and greater insulating efficiency for over a quarter of a century. Pioneered by Union Asbestos, Insutape continues to set the pace in providing a higher degree of efficiency without sacrificing any of its proven application features!

. . . and here is a most significant point for you to consider when thinking about insulation — *most* foreign and U. S. (Army) government locomotives built in this country in the past five years has had Insutape applied. Those engines were equipped to achieve maximum fuel economy — and railroad men serving their government selected Insutape *every time!*

Insutape is the original insulation of this type — the insulation that was designed and engineered by and for railroad men to meet day-in, day-out operating problems.



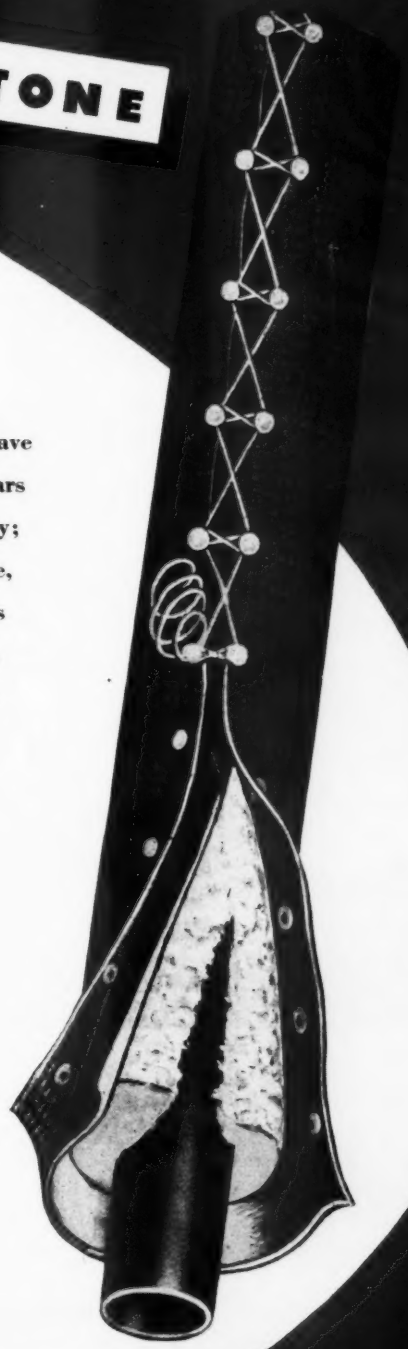
Why accept anything less than the real thing? . . .

332 SOUTH MICHIGAN AVE., CHICAGO 4, IL

IT F INSUTAPE AND WOVENSTONE

WOVENSTONE

UT ND WOVENSTONE
TH SULATION ADVANTAGES



Many Wovenstone steam pipe insulations have been in *continuous service* for 10 to 12 years and continue to give highest insulating efficiency; continue to fit snug and firm against the pipe, carrying steam at maximum temperatures with minimum fuel consumption.

. . . and consider this — Wovenstone jacket and sealing laps are woven in one continuous piece—designed to prevent tearing or splitting— that's because Wovenstone is designed and engineered by men who have specialized in railroad insulation for over a quarter of a century — men who have lived with railroadings' heating problems for many years and then designed Wovenstone to overcome those problems . . .

Yes, Wovenstone's outstanding service record, advanced one-piece design and engineering for greater heating efficiencies with consequent fuel economies and greater comfort to passengers.

Majority of new cars on order and delivered since the war are equipped with WOVENSTONE.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

SAN FRANCISCO

These piles drive straight and fast

You save time and money when you specify ARMCO Welded Steel Piling for foundation work. Long lengths drive fast, stay straight!

Many railroad engineers and maintenance men know why ARMCO Welded Steel Piling is the simple, practical answer to foundation piling problems. They find it ideal for bridges, terminals, and other heavy construction jobs.

These foundation piles *drive straight* with the least time and effort. The tough spiral weld imparts extra lateral stiffness and high collapse resistance to even the longest lengths. Yet ARMCO Foundation Piles are relatively light in weight for quick, easy handling. Long lengths save driving time, cut construction costs.

For greatest economy specify the exact wall thickness you need. Diameters range from 6 to 36 inches, wall thicknesses from 3/16 to 1/2-inch. When you need cone points, end plates or cutting shoes, these can be mill attached. Write for prices. Armco Drainage & Metal Products, Inc., 835 Curtis Street, Middletown, Ohio.

FOR WATER PIPE

ARMCO Welded Steel Pipe is economical for water lines of all kinds. It is supplied with special coatings for water service in 6" to 36" diameters. Also special fittings.

ARMCO

Armco Welded Steel Pipe

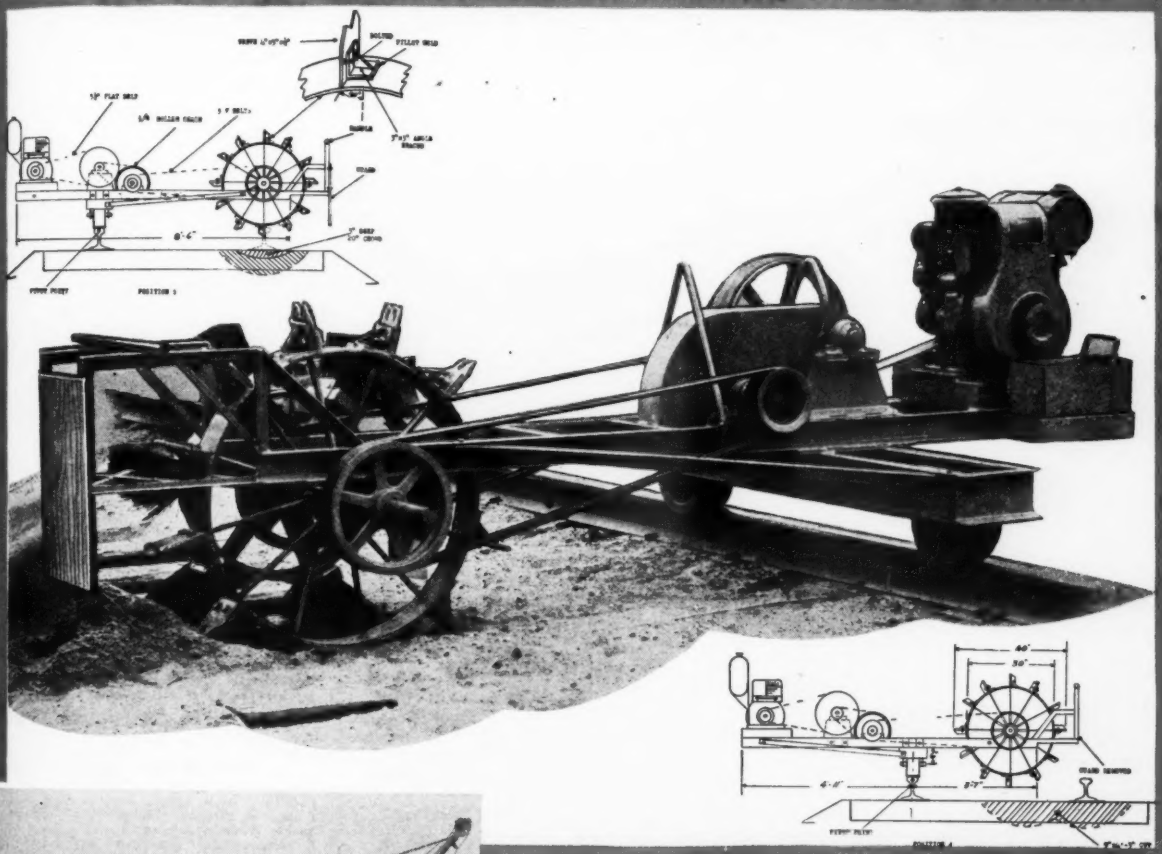
SAVE TIME, COSTS, DO IT BETTER

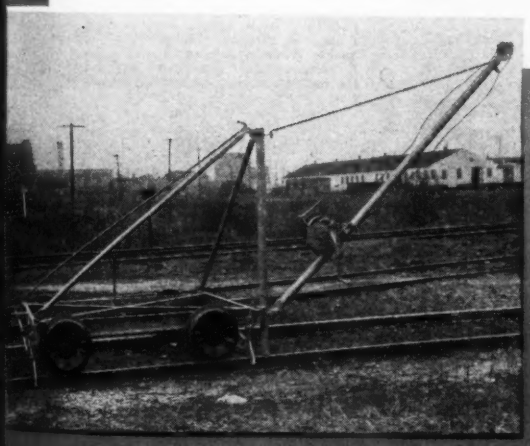
with the

KERSHAW

CRIBBING MACHINE

FOR RELAYING AND STRIPPING OPERATIONS





EXPERIENCE on numerous railroads and railroad contract work has shown that Kershaw Cribbing Machines will crib out for the adzing machine at the rate of 6,000 to 8,000 lineal ft. daily with two operators. Rotating brush sweeps tie clean for adzing in same operation. This machine will save 50% of stripping cost for skeletonizing track. Total machine weight 900 lbs., counterweights 400 lbs.

TWO spike setters with two *Kershaw* Spike-Setter Carriages can set spikes for six hammers at the rate of one 39 ft. rail per minute. Carriage capacity 1½ kegs of spikes. Carriage weight 60 lbs.

WITH the Kershaw 2-ton rail derrick, removal and replacement of track-work equipment, and the handling of bridge timbers, frogs and switches are possible with a minimum of time and labor. The derrick is completely demountable. Ample anchorage is provided by the two self adjusting rail-clamp links. Four men can easily lift car from track.

WRITE US FOR COMPLETE INFORMATION ABOUT THESE TIME AND COST-SAVING MACHINES

RAIL DERRICK
RAIL LAYING CRANE
TIE NIPPER
CRIBBING MACHINE

THE KERSAW COMPANY, INC.

MANUFACTURERS OF RAILWAY MAINTENANCE EQUIPMENT

MONTGOMERY, ALABAMA

Phone 38381 Box 610

BALLAST PLOW AND TRACK DRESSER
BALLAST STRIPPER
SPIKE CARRIAGE

These Grade Trade-Marks on Douglas Fir Plywood mean that you can depend upon uniform quality!

EXT.-D.F.P.A.

GENUINE PLYSCORD SHEATHING D.F.P.A. INSPECTED

GENUINE PLYWALL Douglas Fir Plywood WALLBOARD D.F.P.A. INSPECTED

GENUINE DOUGLAS FIR PLYFORM Concrete Form Panel D.F.P.A. INSPECTED

PLYPANEL D.F.P.A.

Rigid Inspection and Testing Maintain Douglas Fir Plywood Standards

All Douglas fir plywood bearing the "grade trade-marks" shown above are manufactured in accordance with the rigid performance standards in the industry's Commercial Standard, CS 45-45. Conformity to those standards is maintained vigilantly under the continued scrutiny of the Douglas Fir Plywood Association inspectors. Regular testing of glue-line quality at the Association laboratory, involving over 100,000 individual test samples assures the user and specifier of high uniform quality, not only in appearance but also in glue-line performance.

EXTERIOR-TYPE

EXTERIOR-TYPE plywood is made with completely waterproof synthetic resin binder especially for permanent exposure to weather and water. It is widely used for building exteriors, for outdoor signs, for railroad car siding, and in all phases of marine construction.

PLYSCORD

PLYSCORD is an unsanded utility panel of unusual rigidity, made to withstand the rigorous service demanded of wall and roof sheathing and of sub-flooring.

PLYWALL

PLYWALL is the grade of interior-type plywood made for use where only one side is exposed, as in wall paneling. It is suitable for most stained finishes, for painting or papering.

PLYFORM

PLYFORM is the special concrete-form grade of Douglas fir plywood — a quality grade manufactured with highly water-resistant glues and intended for multiple re-use in form construction.

PLYPANEL

PLYPANEL is the grade of interior-type plywood made especially for high quality interior work on walls, ceilings, for booth partitions, cabinet doors and similar uses.

Substantial Production Now Allocated to Veterans' Housing

Allocation of plywood to meet the needs of the Reconversion Housing Program means that a large proportion of the Douglas fir plywood industry's production must go to housing contractors, stock cabinet manufacturers, prefabricators and distributors.

Naturally, the supply situation for all other industrial and construction uses is temporarily acute.

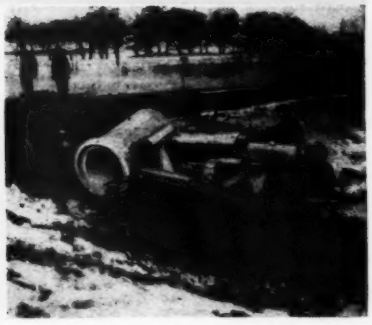
It is a fact, however, that more plywood is being produced today than in pre-war years. So once the present overwhelming demand has been met, an increased amount will be available.

Anticipate your needs as far in advance as possible — and discuss them with your regular source of supply.

DOUGLAS FIR PLYWOOD LARGE, LIGHT, STRONG Real Wood PANELS

DOUGLAS FIR PLYWOOD ASSOCIATION TACOMA 2, WASHINGTON

Laying pipe's a "pipe" with this equipment



NORTHERN PACIFIC *right-of-way near Duluth, Minn. Installing 40 feet of culvert tile in 9-hour day. Tractor uses about 1 gallon of 8½c fuel in an hour.*

A BULLDOZER at the front—a Hyster winch at the back—and a special demountable boom for operating drag-line. . . . Tie these up to the power, traction and maneuverability of a rugged "Caterpillar" Diesel Tractor, and you have one of the most versatile, fastest working rigs for right-of-way maintenance ever devised.

Reaching "in and under" to excavate dirt—spreading and back-filling—moving and placing heavy pipe. . . . These and many other jobs (like ditch cleaning, bank sloping, shoulder building, ballast spreading) are really a "pipe."

And—"Caterpillar" Diesels are virtual Methuselahs of long tractor life, as you'll find when you see the hour meter measuring out their many thousands of work hours.

Your "Caterpillar" dealer has some "eye-opening" facts about these husky work units—and about the efficient service behind them.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR DIESEL

REG. U.S. PAT. OFF.

ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

Grass
is your
real problem
GCX
3.01
...CONTROL IT WITH BYSULOX*!
Noxious grass is the real problem in maintaining "weed free" track. Kill it successfully and weeds automatically fall by the wayside. "But can this be done?" railway maintenance officials ask. Now—for the first time—the answer is a certain "Yes!"

*REG. U. S. PAT. OFF.

Success Now Purchasable

The Method: Properly planned applications of General Chemical Bysulox "A" and "C" chemicals have successfully controlled long-established infestations of such noxious grasses as Horsetail, Quack grass, Johnson and Bermuda grasses! That's because these unique developments of General Chemical Research are not ordinary "weed killers"... because their chemical formulation is based on an entirely new principle of control.

BYSULOX
KILLS GRASS

Perfect Hazard Record!

Thousands of miles of track have been treated with these new Bysulox chemicals over a three-year period, yet not one case of livestock poisoning has been reported.

Planned Service

General Chemical's Railroad Service provides the most advanced type of Spray Train operated by highly trained supervisors using the latest techniques in chemical application. With this program, spray operations are continuous and automatic. No mixing of chemicals is necessary at water towers, and work crews are held to a minimum.

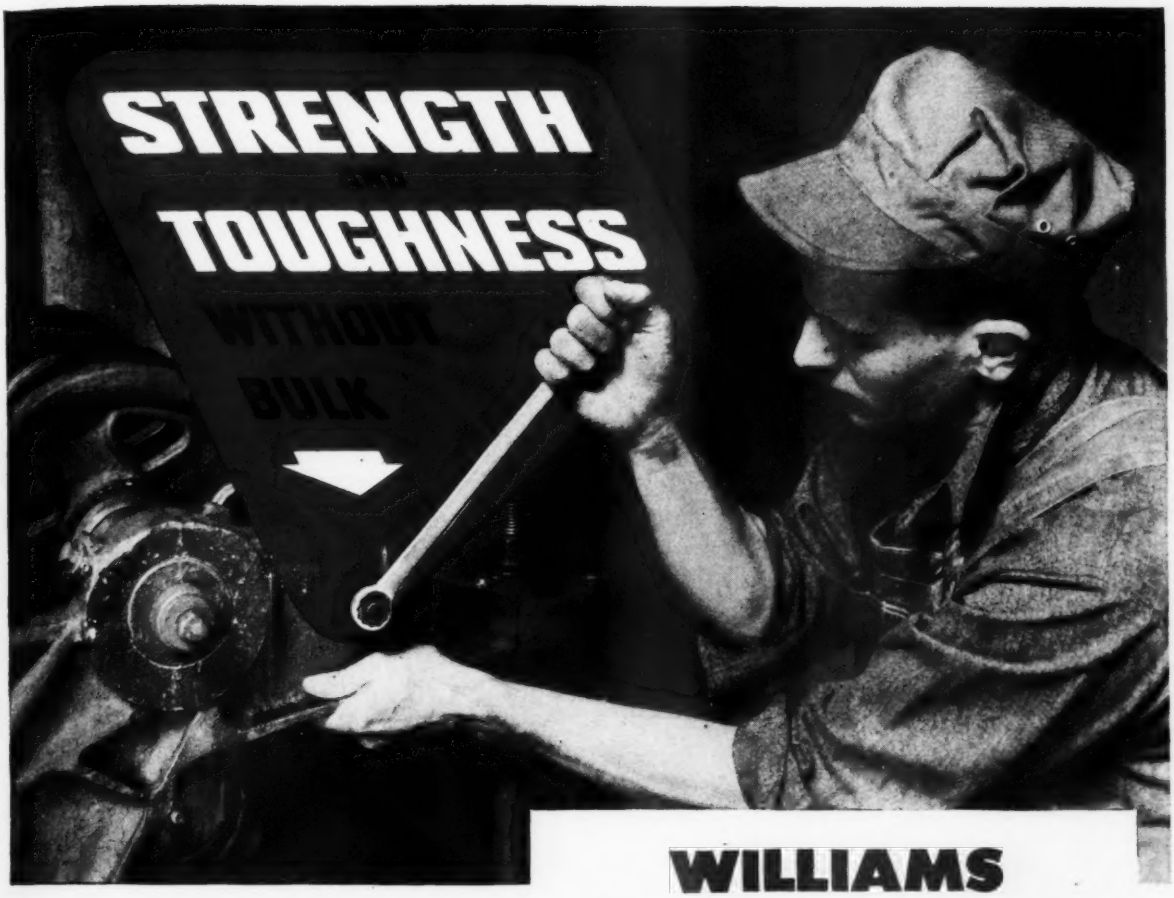
The Company will gladly assist railroads in developing 1947 weed control programs which are individually and properly planned for areas to be treated. All recommendations are based on thorough track inspection with regional and divisional statistical cost analyses.

With such a program you can get the grass ... so plan on Bysulox for 1947. For consultation and planned service, write:

GENERAL CHEMICAL COMPANY

Weed Killer Division

40 Rector Street, New York 6, N. Y.

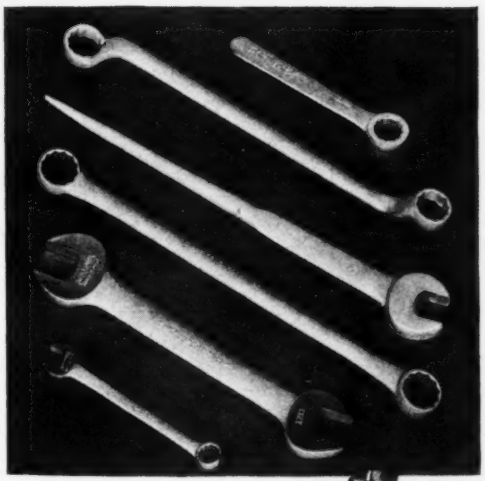


WILLIAMS "SUPERRENCHES"

● If you want the maximum in wrench strength and toughness with an absolute minimum of bulk and weight . . . your answer is a Williams "Superrench."

These fine wrenches are drop-forged from selected alloy steel and heat-treated, permitting trim, slim lines and exceptional balance. Made in a wide variety of patterns and sizes. Attractively finished in chrome-plate, over nickel, with highly-polished heads. Sold by leading Industrial Distributors everywhere.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y.

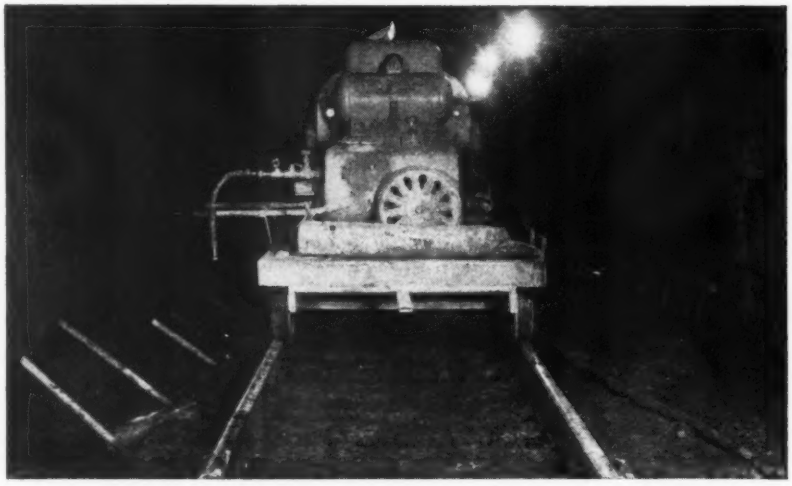


WILLIAMS

DROP-FORGINGS AND DROP-FORGED TOOLS

Pressure Grouting Stabilizes Tunnel Subgrade

Operation reduces track maintenance and permits Spokane, Portland & Seattle Railroad to remove 10 m. p. h. slow orders of 35 years standing.



A grout injector of ¼-cu. yd. capacity, mounted on a push-car, injected the grout pneumatically at 90 p. s. i. pressure.

Portland cement grout pumped under pressure into the wet subgrade of the Fort Wright Tunnel on the Spokane, Portland & Seattle Railroad, near Spokane, Wash., has stabilized the soft subgrade and permitted the railroad to remove slow orders of 35-years standing.

Since shortly after the tunnel was completed in 1910, the watery subgrade has caused operating problems, high maintenance and slow orders. Train speeds were limited to 10 m.p.h.

Now for the first time in 35 years trains are operating through the tunnel at normal speeds and track maintenance on the 2,134 ft. length of the tunnel has been greatly reduced.

Quicksand and Clay

Most of the Fort Wright Tunnel is on a 3-degree curve. The bore was driven through quicksand, clay and "rotten" rock. Considerable water was encountered during the boring operations.

Shortly after the tunnel was opened, soft spots developed and bulges of clayey materials, quicksand and water pushed up through the ballast every time a train passed. At times water covered the ties. This condition required constant efforts of section crews to remove muck from the drainage ditches and maintenance cost was extremely high.

After investigation of track grouting operations on several other railroads, S. P. & S. engineers decided to try pressure grouting in the Fort Wright Tunnel.

In January 1945, work was started under the direction of E. B. Stanton, maintenance-of-way engineer. N. S. Westergard, roadmaster at Pasco, was in direct charge of the work in the field.

Beginning at the west portal, the track was grouted throughout the full length of the tunnel and more than 200 ft. beyond the east portal, a total distance of 2,350 ft. The job was completed in 70 days. The work was done under force account by Clifton & Applegate, general contractors.

Throughout most of the work the grout injection pipes were driven at every second tie. The mixture used consisted of 6 parts portland cement, 3 parts blow sand, 1 part diatomaceous earth and 10 parts water.

A grout injector of ¼-cu. yd. capacity, mounted on a pushcar, injected the grout pneumatically at a pressure of 90 p. s. i. (Grouting technique is described in detail in "Stabilizing Railroad Track by Pressure Grouting", published by the Portland Cement Association.

Quantities Varied

Total quantities of materials used indicated that an average of a ¼-yd. batch was used for every two injection points. Quantities per grout point varied, however, from as little as one ¼-yd. batch for four or five pipes to as much as five batches for a single pipe.

After the grouting was completed the foul ballast and dry mud were replaced with new ballast, bringing the track to proper grade and alignment. It has since remained stable under normal train speeds.

• • • • • • •

More than 35 major railroads are using pressure grouting with portland cement to eliminate water pockets or soft spots and increase the load-carrying capacity of troublesome subgrades.

In nearly every instance where pressure grouting has been tried, the entire cost has been returned within a few months by savings in maintenance.

PORTLAND CEMENT ASSOCIATION

Dept. 10-27, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete ... through scientific research and engineering field work.

In grouting the Fort Wright Tunnel, injection pipes were driven at every second tie, at an angle so that bottom of pipe was about under the rail.
(Photographs and factual data courtesy Western Construction News)

HERE'S A NEW PLATFORM MATERIAL WITH NEW SERVICE POSSIBILITIES

KOPPERS ASIDBAR*

The terrific beating that platform flooring has to take means early deterioration for ordinary materials, and many engineers accept frequent replacements as a necessary evil.

Such replacements aren't necessary . . . now. An important new Koppers development fortifies wood against failure, greatly extends the useful life of the floor.

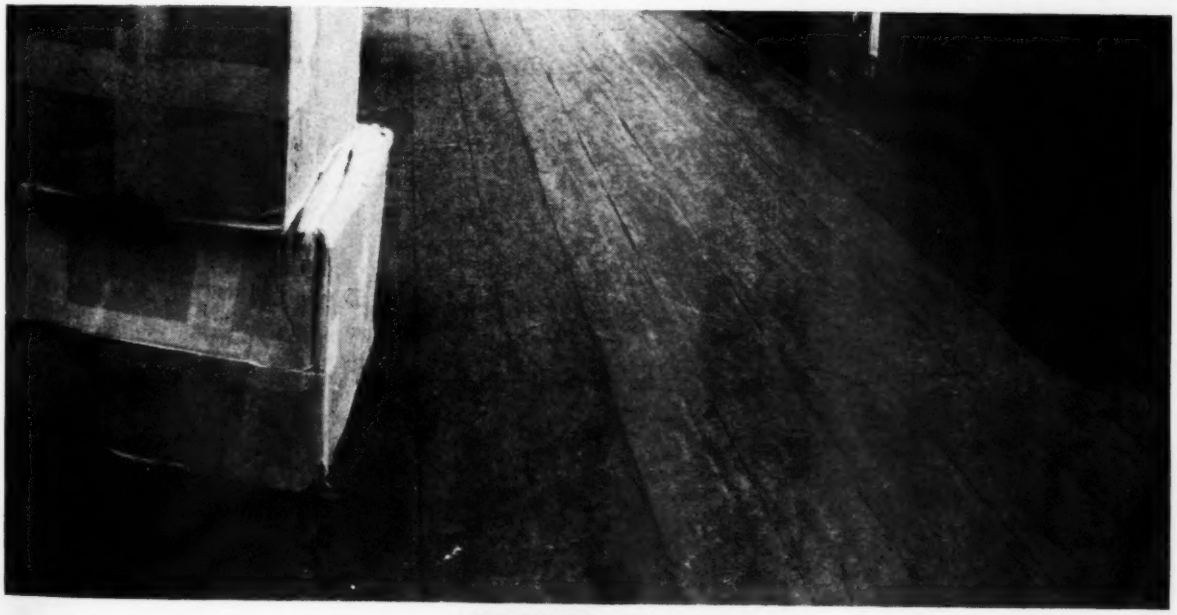
The material is "Asidbar"*—wood processed to obtain deep penetration and distribution of a special bituminous compound. The injected material coats and fills the fibers to a considerable depth in thick members, and throughout in pieces of moderate cross-section. Both surface and interior wood fibers are protected against deterioration, absorption of moisture is reduced, and decay is combatted. The wood can be worked with ordinary tools, and is dry at ordinary temperatures.

In addition to its wear-resistant qualities, Asidbar has some important advantages in special applications. Its resistance to the attack of many acid solutions and corrosive vapors recommends it for platforms, stairs and floors in areas exposed to such conditions.

We will be glad to give you information on Asidbar if you would like to have it. Just drop us a line. Koppers Company, Inc., Pittsburgh 19, Pennsylvania.

*Trade Mark

Asidbar flooring (lighter colored) still good after an extended period of punishing service.



K KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA

A HAMMER TOOL FOR EVERY JOB
STAR DRILL: For clean round holes in concrete, brick, cement, etc.
BULL POINT: For demolition work on concrete, stone, brick, etc.
SPEED BIT: Cuts small holes faster than star or diamond drills.
COLD CHISEL: For chiseling, scaling, surfacing concrete or metal.
WOOD CHISEL: For cutting in wood and compositions.
BUSHING TOOL: For removing form marks or scuffing concrete surfaces.
SEAM TOOL: Cleans out old mortar between bricks or masonry for repointing.

This Tool Saves You

MONEY . . .
MUSCLE . . .
MAN-HOURS

on any hammering job that uses tools like these

Put Black & Decker Portable Electric Hammers to work on your toughest jobs . . . and watch your savings mount up! These high-speed, hard-hitting Hammers drill or channel in brick, stone or concrete . . . chip, clean and scale metal . . . gouge, shape and notch timber . . . drive spikes . . . tamp and vibrate concrete forms . . . scuff concrete surfaces and remove form marks . . . handle brute-force demolition . . . save time and effort on countless jobs from seaming and caulking to tree surgery.

Light, compact and completely self-contained, a Black & Decker Electric Hammer requires no transformer or extra equipment . . . operates wherever there is an electric outlet, AC or DC, or from a portable generator.

Our free "Hammer Handbook" is packed with facts and on-the-job photographs which show how Black & Decker Portable Electric Hammers make quick work of tough hammering jobs. Write for your copy to: The Black & Decker Mfg. Co., 663 Pennsylvania Ave., Towson 4, Md. For full information on Hammers and expert help on any tooling problem, call your nearby Black & Decker Distributor.

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PORTABLE ELECTRIC TOOLS

How the Double Heat Treatment of Oliver Track Bolts

reduces Track Maintenance

1. By DOUBLE heat-treating all Track Bolts, Oliver adds to the strength—and thus to the holding power—of the bolts. This means that they can be drawn up to maximum tension, assuring a tighter, longer-life track joint, and reducing your track maintenance.

2. Oliver's DOUBLE heat-treatment assures dependability and uniformity of Oliver Track Bolts. This means more uniform track joints all along the line, because every Oliver bolt is just like every other Oliver bolt, made according to your specifications.

WRITE for the Oliver Catalog of Railroad Products.

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH 3, PENNA.

"CZC"- TREATED WOOD has many features which especially recommend it for loading platforms. It prevents decay and resists termites. It is resistant to fire and abrasion.

Maintenance costs are lowered wherever "CZC"-treated wood is used. Du Pont Chromated Zinc Chloride makes wood durable—last longer. Treated wood is clean and easy to handle, has no objectionable odor to contaminate foodstuffs when stored on platforms awaiting shipment.

The proven effectiveness of "CZC"-treated wood recommends it for *all* railroad structures. Find out about this wood preservative that cuts maintenance costs to a minimum. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware.

SEE FAIRBANKS-MORSE FIRST FOR MOTOR CARS

PROVED dependability, safety, and efficiency are important reasons why American railroads have used Fairbanks-Morse Motor Cars profitably for more than 50 years... important reasons why you, too, can use them to good advantage.

Most models are powered by a sturdy, two-cycle, reversible engine which has extra power for curves and grades. The lightweight is a feature especially desirable in this day of high-speed passenger and freight schedules.

There are Fairbanks-Morse Motor Cars for signal maintainers, track inspectors, superintendents, and section or bridge gangs, all made under one guarantee by one manufacturer.

Write today for full details on these economical, smooth-performing cars. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

The powerful Fairbanks-Morse No. 53 car is light enough for one man to handle, yet carries a full section or bridge gang with tools. Hauls loaded trailers with ease.

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A name worth remembering

Diesel Locomotives • Diesel Engines
Scales • Motors • Pumps • Generators
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

PHOTO—COURTESY DENVER & RIO GRANDE WESTERN RAILROAD CO.

A Fence for Every Purpose

CF&I manufactures "a fence for every purpose." COLORADO FENCE serves the railroads in many ways; for rights of way, stock pens, yards, shops and slide detectors.

COLORADO ***woven wire*** FENCE 55 inches high is admirably adapted to slide detectors such as the one pictured above which is a typical installation in the Rocky Mountains. Specify Colorado Fence for all railroad uses.

COLORADO RAIL

A PRODUCT OF THE COLORADO FUEL & IRON CORPORATION

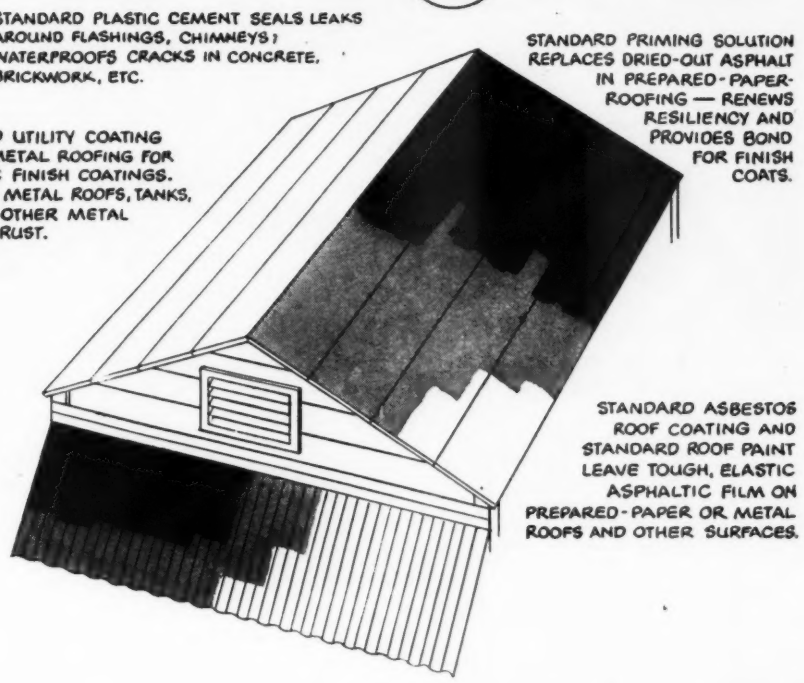
CF&I

EXECUTIVE OFFICES: DENVER, COLO. • RAIL MILL: PUEBLO, COLO.

STANDARD ENGINEERS NOTEBOOK

CALOL

RPM


STANDARD PLASTIC CEMENT SEALS LEAKS AROUND FLASHINGS, CHIMNEYS; WATERPROOFS CRACKS IN CONCRETE, BRICKWORK, ETC.
STANDARD PRIMING SOLUTION REPLACES DRIED-OUT ASPHALT IN PREPARED-PAPER ROOFING — RENEWS RESILIENCY AND PROVIDES BOND FOR FINISH COATS.
STANDARD UTILITY COATING PRIMES METAL ROOFING FOR ASPHALTIC FINISH COATINGS. PROTECTS METAL ROOFS, TANKS, PIPE AND OTHER METAL AGAINST RUST.
STANDARD ASBESTOS ROOF COATING AND STANDARD ROOF PAINT LEAVE TOUGH, ELASTIC ASPHALTIC FILM ON PREPARED-PAPER OR METAL ROOFS AND OTHER SURFACES.

Asphaltic Coatings weatherproof, help prevent rust

Because they are made of the finest asphalts, special thinners, drying oils and other selected ingredients, Standard Roof Coatings provide economical, long-lasting protection against the elements.

Standard Plastic Cement, for patching, and filling cracks, has a special type asphalt base which prevents its becoming hard and brittle after application. It is filled with asbestos, minerals and an additive that helps it stick to wet surfaces.

Standard Asbestos Roof Coating, top-quality asphaltic roof paint, contains asbestos which binds and increases the tensile strength of the film it leaves; reduces "shrinking", "alligatoring" and "dusting". Due to a mineral pigment ingredient, it weathers to a uniform slate-gray color. This pigment prevents ultra-violet ray penetration and the color absorbs a minimum of the sun's heat rays.

Standard Roof Paint is similar to Standard Asbestos Roof Coating, with the principal exception that it does not contain asbestos or mineral pigment.

Standard Priming Solution, a light-bodied asphaltic liquid, is for revitalizing old prepared-paper roofing before painting with Standard Asbestos Roof Coating or Standard Roof Paint. It penetrates and saturates the paper fibers and provides a good "tooth" for the finish coats.

Standard Utility Coating provides a strong asphaltic bond on metal roofing to hold Standard Asbestos Roof Coating or Standard Roof Paint. It is quick-drying and of paint-like consistency. Used alone, it's an efficient seasonal protector against rust and corrosion for metal roofs, machinery, parts, etc.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Col.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

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FOR IMMEDIATE SALE

Standard and Non-Standard O. D.'s and Wall Thicknesses
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Price: ALL TO BE SOLD ON FIXED PRICE BASIS, F.O.B. LOCATION.

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Orders received by 5 p. m., November 4, 1946, will be filled in the following sequence, as provided by law; (1) certified Veterans of World War II; (2) subsequent priority claimants in proper sequence; (3) non-priority purchasers. Veterans of World War II should apply to their nearest War Assets Administration certifying office for certification; the case number shown on certification and the location of the certifying office must be stated in a Veteran's offer to purchase.

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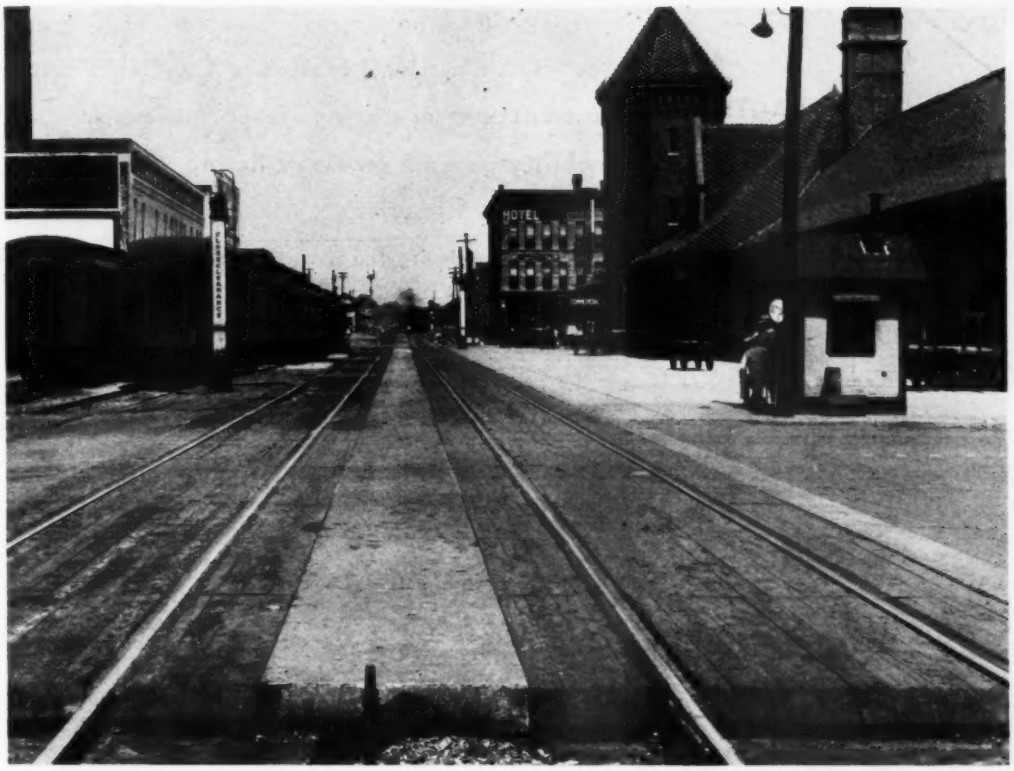

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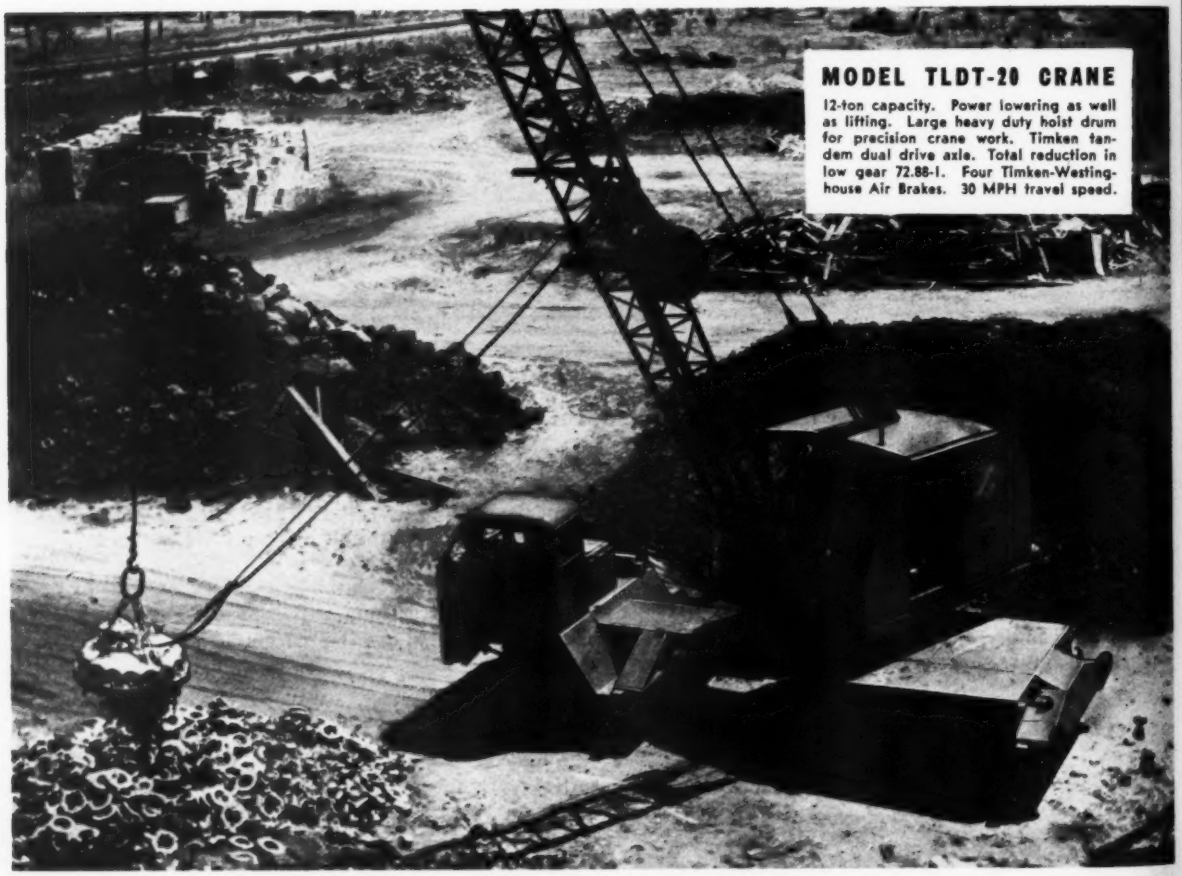

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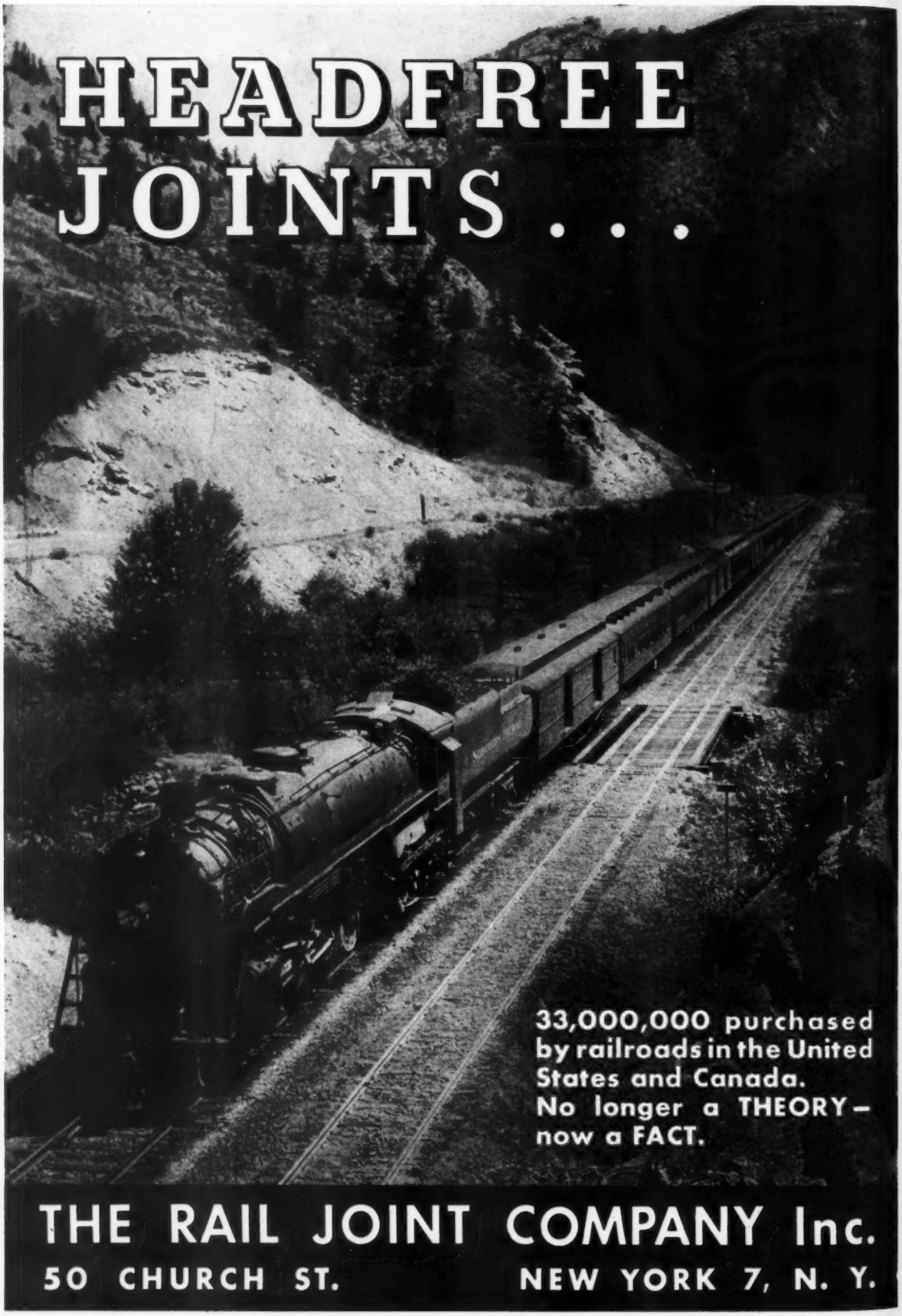
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Subject: Roadmasters' Convention Issue

October 1, 1946

Dear Readers:

With this issue we continue a long-standing service to the Roadmasters' and Maintenance of Way Association and, we are sure, to you also. For the thirty-first time we present a Roadmasters' Convention issue. In fact, even in those few years of depression and war when the Roadmasters were unable to hold conventions, we have presented Convention-in-Print issues.

Here again, therefore, is an issue given over largely to a report of the outstanding annual meeting of the Roadmasters in Chicago, September 17-19, which presents, in addition to a running story of the three-day activities of the meeting, all of the technical committee reports in full, together with abstracts of many of the papers and addresses, and of the discussion from the floor.

You will note too, as mentioned in the convention story, that we plan to devote our November issue largely to a similar report of the activities of the American Railway Bridge and Building Association's annual convention, which this year, for the first time, was held concurrently with that of the Roadmasters—again continuing a long-standing practice which we have every reason to believe is in the interest of the Bridge and Building Association and so many of you.

Why do we of the staff of Maintenance devote so much of our time, effort and editorial space to the activities of these associations? There are several important reasons. First, we believe the work of these associations to be of inestimable value to the railways and to every supervisory officer engaged in roadway, track, bridge, building and water service work. Second, with this high regard for their work, we want to support both associations to the fullest of our ability. Third, in the interest of all concerned, we seek to bring to you, members or not, the deliberations of these associations at the earliest possible moment—and months before you could receive the complete reports otherwise.

Fourth—it is only natural that we should co-operate so fully with these associations. Our entire editorial purpose as a publication is in the interest of the industry of which they are a part, and of their members and others engaged in roadway and structures work. All of us on the staff of Railway Engineering and Maintenance believe sincerely in the old adage that "He profits most who serves best."

Sincerely,

Neal D. Howard

NDH:jb

Editor

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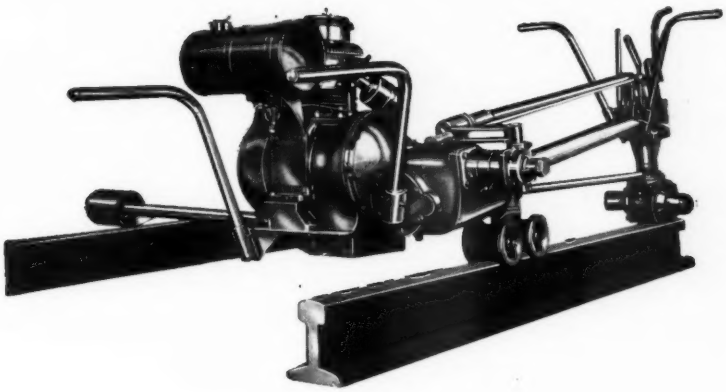

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Railway Engineering and Maintenance

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October, 1946

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FIG. 36-H (Pat.)
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FIG. 36-D (Pat.)
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Railway Engineering and Maintenance

A Dilemma

Railroads Caught Between High Costs and Low Earnings

The railways of the country are in a dilemma—a dilemma that, until dissipated, augurs ill for them, their employees, hundreds of other industries, and the very economy and safety of the country itself. Coming out of the recent war with its extreme military and industrial demands on them on the one hand, and labor and material shortages that seriously restricted improvements on the other, the railways have been raring to go—to step out with widespread improvements to effect increased operating economies and to improve their services to the public—but have been practically stopped in their tracks by the policies of some elements of organized labor, and of politicians and bureaucrats, that have hiked labor and material costs to new high levels while strangling the earning power of the roads, and thus their ability to make the improvements contemplated.

As pointed out in an address recently by John W. Barriger, president of the Chicago, Indianapolis & Louisville, a very much finer and more perfect plant will be required to enable the railways in the immediate future to render the kind of service that will attract business at rates which, after paying current wages and material costs, will still leave a margin of operating profit commensurate with the capital and credit necessities of the railways.

According to Mr. Barriger, post-war reconversion of the railways calls for easy grades and curves; 112, 131 and 152-lb. rail; signal systems that will permit train operation on all main lines, whether single, double or multiple track, to be made entirely independently of time-tables and train orders; motive power of sufficient capacity to haul 5,000-ton freight trains at an average speed of 35 m.p.h. over entire divisions, and 15-car passenger trains at an average speed of 70 m.p.h. from terminal to terminal; continuous communication between trains and dispatchers and between locomotives and the rear ends of trains; all cars of adequate design and strength for inclusion in trains of maximum weight and speed, and carefully adapted to all the reasonable necessities of patrons of freight and passenger service; adequate intermediate locomotive servicing facilities, so that servicing en route can be held within the time limit of stops for traffic purposes; and a similar range and degree of improvements in the facilities used by the maintenance and non-operating departments.

Railway officers and employees, generally, agree with Mr. Barriger in these and other post-war needs of the railways—and are anxious to provide them. Indeed, the railways must provide them if they are to produce competitively successful service, both passenger and freight, and sell it profitably at competitively-successful prices. But to make such improvements requires that they be permitted to earn adequate net operating income, both to provide funds from their own resources and to attract capital from investors. Herein lies much of the present difficulty, as the railways, under the rates allowed at present, cannot earn the funds necessary for the improvements required, and cannot be assured of the necessary outside capital, since such capital can be attracted only by giving reasonable assurance to investors that they will be adequately compensated.

Unfortunately, most of the railways of the country cannot give that assurance with the desired degree of definiteness, and certainly not on their showing during the first half of the present year when, as a whole, they incurred a deficit, in spite of traffic levels far above previous peace-time records. Even at the moment, some of the largest and most important railways of the country are testifying before the Interstate Commerce Commission in the current freight rate hearings that they are now operating deeply in the red, and will roll up even larger deficits in 1947 unless freight rates are increased.

(Continued on next page)

Indeed, as pointed out recently by Phil Hanna, financial columnist for the Chicago Daily News, the railroad industry at the present time is a "Sick Giant." It built up reserves and reduced its indebtedness during the war, but like so many other large industries burdened with increased wage and material costs, it is now rapidly using up its liquid capital in paying costs that are far out of line with the inadequate charges it is permitted to make for its product.

The country gets its waterway, highway and aviation facilities largely by voting huge outlays of public money for their construction, and Congress lost no time in doing this to the tune of many millions of dollars as soon as the war ended. By contrast, the only way *privately financed* transportation can provide itself with the funds necessary for additions and betterments is to hold out a hope to investors that the money they put into such facilities will receive a reasonable return. This assurance the Interstate Commerce Commission is persistently refusing to give. Proceedings in the current freight rate increase case, which it had been hoped might be concluded in time to give the railroads a reasonable level of earnings for the last two months of the year, have now been prolonged to delay the remedial action, probably until the end of the year. Meanwhile, the railway industry as a whole stands still, or is actually slipping backwards.

The public must be made to understand the seriousness of the situation facing its most essential form of transportation. It must be made to understand that the railways cannot increase their efficiency and keep rates to a minimum without the necessary capital for improvements; that it cannot have the finest railways in the world, with all the improved services promised, unless the railways are allowed to have sufficient earnings to attract the necessary capital to provide these improved services. Furthermore, the public must be made to understand that the economic health of the country itself, as well as its military security, depends upon healthy railroads. That the public understands these facts is in part the duty of every railroad employee.

Power Tools—

What Limit for Small Jobs?

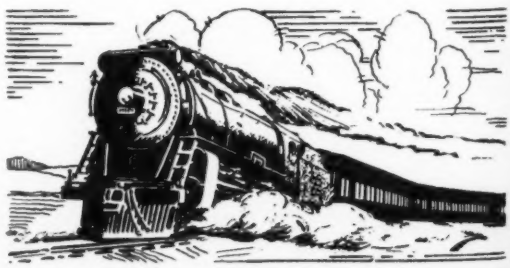
FOR a number of years after the introduction of power machines there was a strong reluctance on the part of supervisory officers to utilize these machines in their daily tasks. They had been raised and educated in the days and methods of hand labor and, almost instinctively, they resisted the compulsion to change these methods, which was inherent in the use of power machines. Even so valuable an aid as the rail crane made no headway against this resistance until its use was forced by the constantly increasing weight of rail, which finally got beyond the possibilities of being laid by hand methods, thereby leaving no alternative but to use the crane.

With a few notable exceptions every other power machine met with similar resistance, and the manner in which those that survive today finally made a place for themselves, despite a deep-seated opposition on the part of many maintenance officers to changing their practices, is an interesting study. Small power tools met with a similar reception, and in some cases the effort necessary to gain a foothold was more severe and prolonged than that attending the introduction of the larger machines.

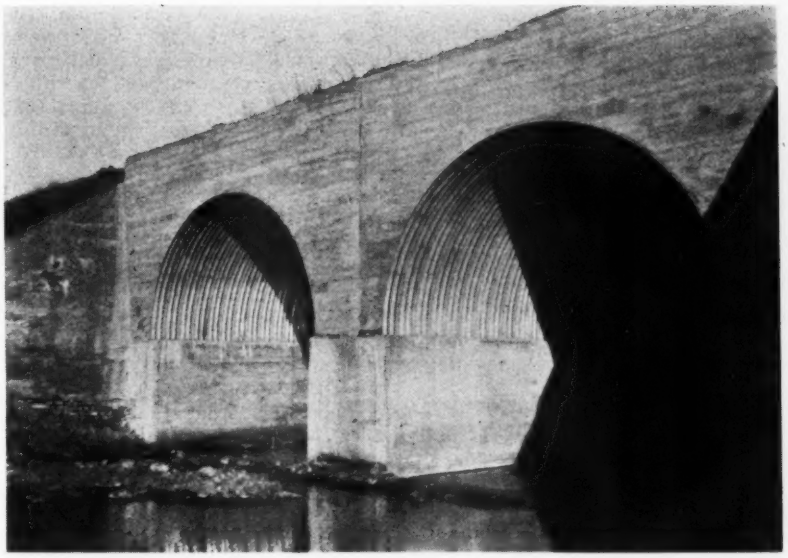
Almost the earliest of the portable hand-operated power tools for track work was the tie tamper. This was followed slowly by other types; those for bridge work including power tools for riveting and cutting rivets in structural steel. There followed a number of designs of power-driven wood-working tools for use by bridge and building carpenter gangs, but these made their way as slowly as their forerunners. Having established themselves, however, there is abundant evidence that the small power-driven wood-working tools are here to stay. Furthermore, there is equally abundant evidence that there is an almost unlimited field for expansion in their use, and a corresponding desire on the part of bridge and building men for more units of every type.

As an example of this change in viewpoint, in a recent discussion it was stated by more than one supervisory officer, including several division engineers, that there is hardly any job of bridge and building work so small or so unimportant as to exclude their use, provided they are suitable for the work that is to be done. In addition, a number of them said frankly that if these tools had not been available to them during the recent period of severe labor shortage, they would have been unable to have kept up, even approximately, with the demands that were made upon them in the form of work that had to be done.

As train schedules continue to be shortened, as the shortage of timber and lumber continues, as it is likely to do for some time to come, and as skilled labor remains scarce, the demand for more precise work, for greater conservation in the use of forest products, and for greater output per man, will all become more insistent. All of these objectives can be attained through the use of these easily-portable, hand-operated, power-driven woodworking tools. Experience has shown that they increase the output of small gangs as well as of individuals. They tend to shorten the time of completion of almost all types of work, regardless of its magnitude, and they reduce the effort that must be exerted by the workmen. Furthermore, both experience and observation demonstrate that they produce neater and more uniform work than that performed by hand. In fact, all evidence is in their favor, and there seems to be none against them.



Forestalling the complete reconstruction of a large twin-arch concrete masonry culvert which had deteriorated badly, the Chicago Great Western recently completed the repair of the structure by employing Armco galvanized iron liner plates and pressure grouting behind them. This method speeded up the restoration work, proved economical, and minimized the reduction required in the waterway opening.



Below—View of Deteriorated Twin-Arch Masonry Culvert on the C.G.W., Near Bristow, Iowa, Before Relining. Right—Same Structure with New Bench Walls, Liner Plates and Headwalls

Liner Plates Save Twin Arch

THE problem of how to avoid the complete reconstruction of one of its important concrete masonry arch culverts, badly deteriorated with age and service, was recently solved expeditiously and economically by the Chicago Great Western through the installation of concrete bench-wall jackets, galvanized iron liner plates in the arches, and new headwall facings. The structure, located over Otter creek, near Bristow, Iowa, on the line of the road between Chicago and Omaha, Neb., was built in 1903 when the line was constructed. It consisted of twin semi-circular arches 50 ft. long, each with a span of 25 ft., with their spring lines about 10 ft. above streambed. Both headwalls, of concrete masonry, have wingwalls.

Badly Deteriorated

Structurally, the concrete in the side or bench walls was in fair condition, but in the arch barrels much of the fine aggregate had disintegrated and fallen out. Furthermore, the headwalls were badly cracked and bulged outward as much as 12 in.; one of the buttresses of the center pier was partly disintegrated; and the other buttress was cracked all the way through.

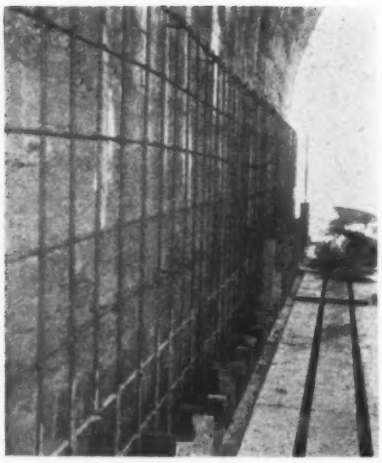
To overcome the unfavorable conditions, and at the same time completely stabilize the culvert, two methods of repair were considered. One was to face the bench walls, headwalls and wingwalls with a 2-ft. reinforced concrete jacket, and the arches with a similar jacket 1 ft. thick. The other method, which was the one chosen, consisted of facing the bench walls with a 1-ft. reinforced concrete jacket; lining the arches with Armco galvanized structural liner plates and pressure grouting behind these plates; and placing a 2-ft. thick reinforced concrete facing on each headwall. This latter method was particularly attractive because it minimized the reduction in the waterway opening and could be done more economically than the first method considered.

Rehabilitation Work

The restoration procedure was relatively simple. After first excavating to bed rock along each side wall, which was reached at a depth of 15½ to 18½ ft. below the spring lines, the new bench-wall facings were poured up to spring-line height. These new jackets were reinforced with ⅝-in. Hibond bars on 1-ft. centers, and were anchored securely to the original masonry by means of ⅝-in. hook anchor dowels set in the old masonry on 4-ft. centers, both vertically and horizontally. Also, to receive the lower edges of the arch liner plates, anchor channels were embedded in the tops of the new reinforced concrete wall facings.

Details of Liner Plates

The corrugated liner plates installed in each arch were made up of a series of 36 prefabricated semi-circular arch rings, each, in turn, being made up of a series of curved plates, of No. 3-gage galvanized metal, 18 in. wide by 50½ in. long, bolted together, with the nuts on the outer side. The successive rings, with joints staggered in adjacent rings, were readily raised into position on the new bench-wall jackets. As each new ring was set in place, it was



Reinforcing for Concrete Bench Wall Jackets Extends from Bedrock to Spring Line

bolted to the preceding ring, again with the nuts on the outer side, where they could be reached readily by men working from scaffolding within the arch.

When the liner plates had been installed throughout each arch, the space between the liner and the old arch face, averaging about four inches, was pressure grouted through standard 2-in. grout couplings that had been provided in some of the top plates at intervals of about six feet. The grout used was a 1:6 cement sand mixture, which was placed under a pressure of 100 p.s.i. with an ordinary pneumatic tank-type placer.

New Jackets and Liners

The new concrete bench-wall jackets and arch liners were placed in the fall of 1945 and the grouting completed at that time. However, because of cold weather, further work was suspended until the spring of 1946, when the new reinforced concrete facings were applied to the headwalls.

The culvert restoration described was done under the general direction of W. C. Groth, chief engineer, and W. R. Roof, engineer of bridges and buildings, of the C.G.W., the actual work having been performed by the construction department of the Des Moines, Iowa, office of Armco Drainage & Metal Products, Inc., under the supervision of J. D. Faylor, construction superintendent, and J. D. Porter, foreman.

New Arch Liner Plates Grouted In Place Ready for Headwall Facing

Enginehouse with Aluminum Roof Trusses

The roof trusses shown in the above photograph were fabricated entirely from aluminum alloy structural shapes and rivets, in an unusual departure from conventional roof truss design. They have 57-ft. spans and are installed in the enginehouse of the Alton & Southern at East St. Louis, Ill., where they replaced four badly corroded steel trusses. This is believed to be the first application of aluminum in railway enginehouse roof construction, the aluminum being selected because of its known resistance to the corrosive gas conditions prevalent in the enginehouse.

Since 1930, when this building began to be used intensively, corrosion of the steel roof trusses had reduced the area of some of the truss members as much as 80 per cent below their original cross section. The most badly damaged members were in the top chords, although web members in the weakened trusses were reduced in area from 12 to 80 per cent.

The aluminum design differs only slightly from the former steel truss design, the principal difference being a slight increase in the thickness of the various members to accommodate the design stresses. Each aluminum truss weighs only 1,805 lb., compared with the 4,255-lb. weight of its steel counterpart. The designing and installing of the trusses was performed under the direction of W. J. Neubling, chief engineer of the A. & S., East St. Louis.

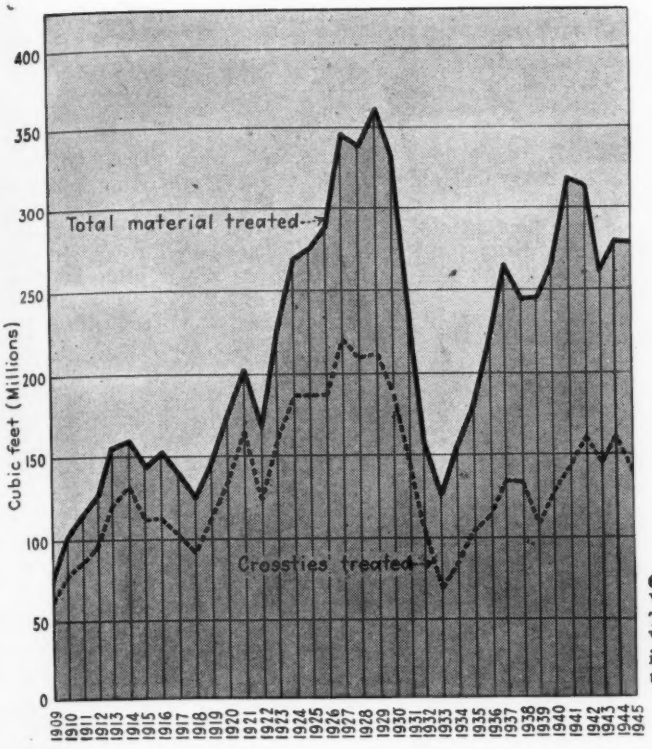


Chart Showing Volume of Ties and All Wood Treated in U. S. Since the Year 1909

A continuance of government restrictions on civilian use of forest products, together with widespread labor shortages throughout the year, combined to prevent more than a negligible expansion, amounting to 0.6 per cent, in production in the wood-preserving industry during 1945. Yet, despite this apparent lack of advance, it should not be overlooked that the volume of wood treated during this year has been exceeded in only two years since 1930, and only seven times since this record was started 37 years ago.

Wood Preservation Holds Its Own in 1945

ALTHOUGH government restrictions against civilian uses of forest products continued with little or no abatement during the year, and although the labor shortages that resulted from war activities were more acute than in previous years, the volume of wood treated in 1945 showed a slight, if almost negligible, gain, amount to 0.6 per cent, compared with the previous year. This indicates the strong position the industry has attained even during the war years and augurs well for a rapid expansion whenever economic recovery for the nation as a whole is allowed to take place.

It is well to note, however, that the increase, small as it was, did not occur uniformly throughout the eight classifications into which treated wood is divided for statistical purposes, some classifications showing large gains, while others registered relatively large losses, compared with the previous year. It is important to bear in mind that, despite these wide fluctuations, the volume of wood treated in 1945 has been exceeded only twice since 1930 and only seven times in the 37 years that these statistics have been compiled.

A total of 279,449,934 cu. ft. of wood was given preservative and fire-retardant treatment during 1945, this being an increase of 1,763,207 cu. ft. over the 277,547,747 cu. ft. given similar treatment in 1944, according to figures compiled by R. K. Helphenstine Jr., Forest Service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association.

For statistical purposes, the material treated year by year is divided into eight classifications and, in general, the gains or losses are somewhat evenly distributed among the several classifications. However, in 1945 there were wide internal fluctuations, ranging from a gain of 41 per cent in the number of poles treated to a loss of 12 per cent in ties, while the overall gain for all eight classifications was only 0.63 per cent. It is of interest, however, that despite this small gain, the amount of wood treated in 1945 has been exceeded in only two years since 1930, and only seven times in the 37 years that statistics have been compiled.

As in all previous years since the beginning of the wood-preserving industry, the railways maintained their position as the principal consumer of treated timber. In recent

Number of Crossties Treated by Kind of Wood and Kind of Preservative—1945

Kind of Wood	Treated with Creosote[1]	Treated with Creosote-Petroleum[2]	Treated with Wolman Salts	Treated with Pentachlorophenol	Treated with Chromated Zinc Chloride	Treated with Zinc Chloride	Treated with Miscellaneous Preservative	Total	Per cent of Total
Oak	13,684,813	3,936,147	1,200	1,600	1,251	.....	.....	17,625,011	37.71
Southern pine	7,190,775	3,237,762	.....	.....	230	.....	.....	10,428,767	22.31
Douglas-fir	800,494	5,203,482	76,555	.....	.....	462	336	6,081,329	13.01
Gum	3,181,035	1,058,441	.....	.....	.....	.....	.....	4,239,476	9.07
Tamarack	.....	1,040,822	.....	.....	.....	.....	.....	1,040,822	2.23
Lodgepole pine	13,675	1,015,000	.....	.....	.....	.....	.....	1,028,675	2.20
Birch	329,103	603,425	.....	500	.....	.....	.....	933,028	2.00
Maple	300,553	584,878	.....	500	.....	.....	.....	885,931	1.89
Beech	456,059	410,760	.....	1,200	.....	.....	.....	868,019	1.86
Ponderosa pine	.....	841,134	.....	.....	.....	.....	.....	841,134	1.80
Hemlock	.....	442,971	.....	.....	.....	.....	.....	442,971	0.95
Elm	160,661	122,445	.....	300	.....	.....	.....	283,406	0.61
All other	1,212,304	813,149	.....	522	.....	.....	10,633	2,036,608	4.36
Total	27,329,472	19,310,416	77,755	4,622	1,481	462	10,969	46,735,177	.....
Per cent of total	58.48	41.32	0.17	0.01	(3)	(3)	0.02		100.00

[1]Includes distillate coal-tar creosote and solutions of creosote and coal tar.
[2]Includes various-percentage solutions of creosote and petroleum.
[3]Less than 0.005 per cent.

years this consumption by the railways has ranged from two-thirds to three-fourths of all of the wood given preservative treatment during the year, remaining at about 75 per cent during 1945. In fact, except for the three years immediately preceding the war, this position as the principal consumer of treated wood was assured to the railways by the fact that crossties had always constituted more than 50 per cent of the total volume of wood treated. Even during these three years, the addition of switch ties, poles, piles and construction timbers, as well as a number of items in the miscellaneous category, brought railway consumption to approximately two-thirds of the total amount of wood treated.

Wood Preservation, 1909-1945
Together with Consumption of Creosote and Zinc Chloride

Year	Total material treated cu. ft.	Number of crossties treated	Creosote used, gal.	Zinc chloride used, lb.*
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,088	40,260,416	108,373,359	26,466,803
1914	159,582,639	43,846,987	88,764,050	27,212,259
1915	140,858,963	37,085,585	84,065,005	33,269,604
1916	150,522,982	37,469,368	96,079,844	26,746,577
1917	137,338,586	33,459,470	83,121,556	26,444,689
1918	122,612,890	30,609,209	56,834,248	31,101,111
1919	146,060,994	37,567,927	67,968,839	43,483,134
1920	173,309,505	44,987,532	70,606,419	49,717,929
1921	201,643,228	55,383,515	77,574,032	51,375,360
1922	166,620,347	41,316,474	87,736,071	29,868,639
1923	224,375,468	53,610,175	128,988,237	28,830,817
1924	268,583,235	62,632,710	158,519,810	33,208,675
1925	274,474,539	62,563,911	169,723,077	26,378,658
1926	289,322,079	62,654,538	188,274,743	24,777,020
1927	345,685,804	74,231,840	221,167,895	22,162,718
1928	335,920,379	70,114,405	222,825,927	23,524,340
1929	362,009,047	71,023,103	226,374,227	19,848,813
1930	332,318,577	63,267,107	213,904,421	13,921,894
1931	233,334,302	48,611,164	155,437,247	10,323,443
1932	157,418,589	35,045,483	105,671,264	7,669,126
1933	125,955,828	22,696,565	85,180,709	4,991,792
1934	155,105,723	28,459,587	119,049,604	3,222,721
1935	179,438,970	34,503 147	124,747,743	4,080,887
1936	222,463,994	37,952,129	154,712,999	4,127,886
1937	265,794,186	44,803,239	183,574,581	4,833,935
1938	244,221,442	44,598,678	166,183,891	4,829,590
1939	245,219,878	35,748,845	163,864,259	4,522,070
1940	265,473,149	42,666,598	174,625,305	5,180,896
1941	319,164,422	47,664,019	215,467,780	5,786,424
1942	312,934,621	54,175,380	216,347,768	5,051,263
1943	261,138,980	48,229,067	177,786,315	3,122,302
1944	277,686,727	53,044,598	188,758,182	2,836,420
1945	279,449,934	46,735,177	195,255,939	2,747,017

* Includes chromated zinc chloride.

A total of 46,735,177 crossties were given preservative treatment in 1945, representing 140,205,531 cu. ft. This was a decrease of 6,309,421 ties, 18,928,263 cu. ft., or 12 per cent, compared with the 53,044,598 ties, or 159,133,794 cu. ft. given preservative treatment in 1944. As in 1944, oak ties ranked first in number, comprising 17,625,011, or 37.7 per cent, of the total number of cross-ties treated during the year. Southern pine retained second place with 10,428,767 ties, or 22.3 per cent of the total. Douglas fir again stood third with 6,081,329 ties, or 13 per cent of all ties treated; and gum retained fourth rank with 4,239,476 ties, or 9.1 per cent of the ties given preservative treatment in 1945.

Ties of other woods given preservative treatment in 1945, including tamarack, lodgepole pine, birch, maple, beech, ponderosa pine, hemlock and elm, in the order given, aggregated 13.5 per cent of the total, while 2,036,608 crossties, or 0.6 per cent of the total, were of woods other than those mentioned.

Of the total number of crossties treated during the year under review, 27,329,472, or 58.5 per cent, were treated with straight creosote or with solutions of coal tar and creosote; 19,310,416, or 41.3 per cent, were impregnated with solutions of creosote and petroleum; 77,755, or 0.2 per cent were treated with Wolman salts; 4,622 ties, or 0.01 per cent of the total, were treated with pentachlorophenol, which appeared for the first time as a preservative for crossties. Only a small number, 1,943, representing 0.005 per cent of the total, were treated with zinc chloride and chromated zinc chloride; while all other preservatives accounted for 10,969 ties, or 0.02 per cent of the total number that was given preservative treatment during the year. All ties were treated by pressure processes.

In the preparation of these ties for treatment 27,926,935, or 59.8 per cent of the total, were adzed and bored prior to impregnation, compared with 34,490,239, or 65 per cent, in 1944; 1,841,053, or 3.9 per cent, were adzed but not bored, compared with 1,206,890, or 2 per cent, in 1944; 3,654,320, or 7.8 per cent, were bored but not adzed, compared with 2,637,311, or 5 per cent, in 1944; and 13,312,869, or 28.5 per cent, were neither bored nor adzed, compared with 14,710,158 ties, or 28 per cent during 1944.

The quantity of switch ties given preservative treatment in 1945 amounted to 118,785,587 ft. b.m., a reduction of 13,488,551 ft. b.m., or 7.5 per cent, from the quantity treated in 1944. As with crossties, oak maintained first place as a material for switch ties, with 69,252,044 ft. b.m., or 58.3 per cent of the total; southern pine retained second place, with 17,882,515 ft. b.m., or 15 per cent of the total; Douglas fir retained third rank, with 10,490,379 ft. b.m., or 8.8 per cent of the total; and gum was again in fourth place, with 9,663,885 ft. b.m., or 8.1 per cent of the total switch ties treated during the year. Maple, beech, birch, tamarack, elm, ponderosa pine, lodgepole pine and a few miscellaneous species make up the remaining 9.8 per cent.

For the first time in several years piles showed an increase, preservative treatment having been applied to 30,348,341 lin. ft., this being 3,191,629 lin. ft., or 11.8 per cent, more than the quantity treated in 1944. For the second time Douglas fir held first place, with 16,231,487 lin. ft., or 53.5 per cent of the total, while southern pine, which stood well ahead of all other species until 1944, remained in second place, with 13,875,033 lin. ft., or 45.7 per cent of the total. The remaining 0.8 per cent was made up of oak, with 65,991 lin. ft., and miscellaneous species, with 175,830 lin. ft.

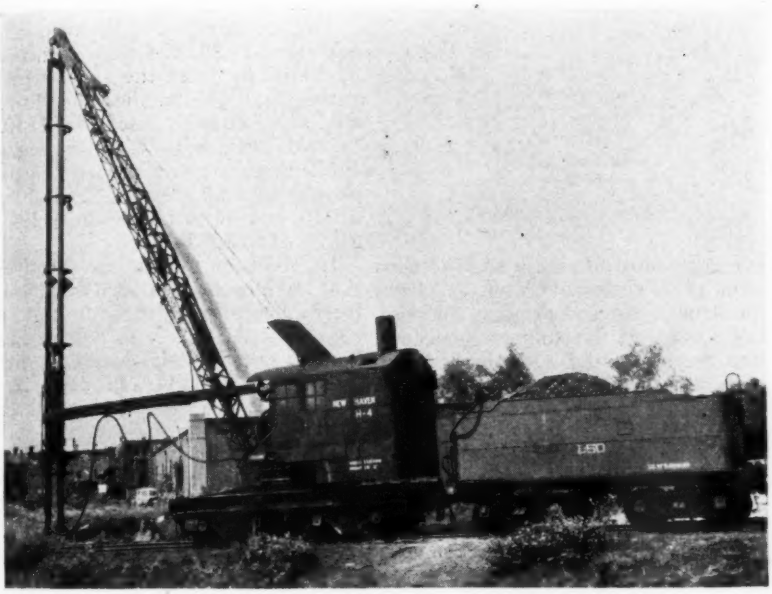
During the year under review a total of 6,748,626 ft. b.m. of wood was given fire-retardant treatment. This represents a reduction of 1,778,802 ft. b.m. from the quantity given this form of treatment in 1944.

During 1945 the wood-preserving industry consumed 195,225,939 gal. of creosote compared with 188,758,182 gal. consumed in 1944, an increase of 6,467,221 gal., or 3.4 per cent. It is of interest that the amount of creosote consumed during the year, despite the many limitations

(*Continued on page* 1052)

Folding Leads for Pile Drivers Save Time and Reduce Hazards

This article describes a design of folding pile driver leads developed by The New York, New Haven & Hartford, which can be connected to a crane boom while lying on a flat car or on the ground. This improvement has eliminated causes of delays and an otherwise dangerous operation.



Locomotive Crane Equipped with Folding Pile Driver Leads. Note the Hinges Below the Third Hoop from the Top

RECENTLY the New York, New Haven & Hartford designed and constructed folding pile driver leads for use with several of its steam locomotive cranes, which can be erected with ease because they can be connected to the crane boom while they are lying on a flat car or on the track, and then raised and straightened. The New Haven does not have regular pile drivers for standby service, but uses instead locomotive cranes, which can be equipped with leads, and are thus available for other work when not needed for driving piles. The folding leads were developed to eliminate delays in starting pile driving operations on emergency jobs, which delays had been experienced in erecting the type of driver leads used formerly. These earlier leads had to be lifted into position by the line cable with the crane boom erect, and then connected to the top of the boom, an operation which was both difficult and hazardous, especially at night and during bad weather.

The new folding leads were constructed in the work equipment shop of the road at New Haven, Conn., and have been in use for about a year with 20 and 25-ton steam locomotive cranes having 50 to 55-ft. booms. These leads can be erected, complete with the steamhammer, ready for driving, in about 20 min., and the design has proven highly satisfactory. In fact, the road has been so satisfied with the leads that it is altering a gasengine crane so that it can use such leads—this unit to be used with a locomotive, or in yards with steam lines, to supply steam for the hammer. Furthermore, the road now has on order four folding leads of similar design, and expects to place orders for three more.

The Folding Leads

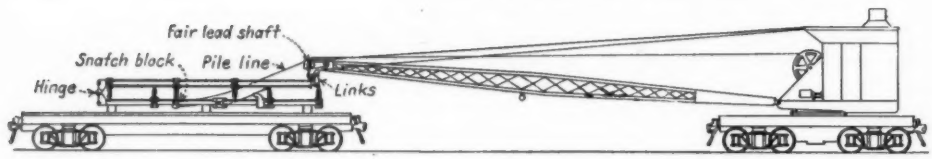
The first step in developing the folding leads was to alter the design of the boom pockets and connection, substituting hinged yokes, or movable links, at the top of the crane boom for the former fixed pin connections. These movable links were connected to the boom and to the pile driver leads with 2¾-in. pins, and permit the upper end of the leads to be fastened to the boom when it is in lowered position.

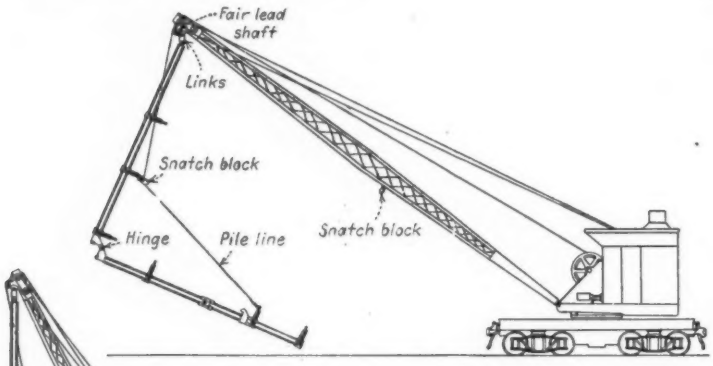
The channels of a standard set of pile driver leads were then cut near the middle of the leads, at a point where the hoops would clear each other when the leads were in the folded position. Two pairs of heavy hinges, with rib reinforcing, were constructed from one-inch steel plate and were welded to the channels. These hinges have 2½-in. hinge pins and can be locked with 1-in. pins when the leads are in vertical position. In addition, the back edges of each pair of hinges are cut to make a tongue and groove fit, which also acts as a lock at the joint to help maintain the leads in positive alinement.

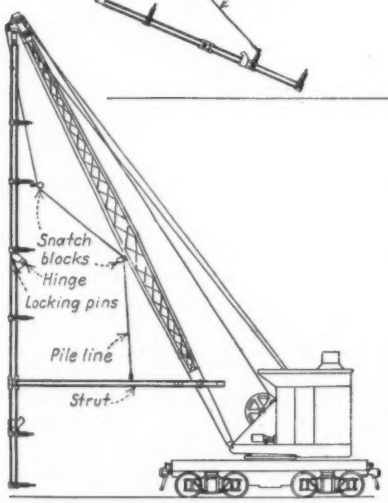
Supplementing these changes, snatch blocks were attached permanently to the second hoop from the top of the leads, and to the lower side of the boom, slightly below its midpoint, for use in erecting the leads and the strut. Ladder irons were also welded in place on one side of the leads, for the full length of one of the channels.

Printed detailed instructions for the handling of folding pile leads are posted in the cab of each crane equipped to use folding pile driver leads and each qualified crane operator has been furnished a printed copy of the detailed instructions for his own reference. These operators are equipped to demonstrate periodically their knowledge of erecting folding pile leads and steam hammer equipment on locomotive cranes with the least possible delay.

With the folding leads, the following erection procedure is used: The leads are placed either on two ties laid across the track, or are left on the car with the free ends facing crane. The crane is then boomed down until the link pins will enter the boom pockets, and the link pins are placed, from inside out, so that the cotter pins are on the outside and can be seen at all times. Next, the pile line is connected for erection, using the snatch block located on the second hoop from the top of the leads and an eye on the second hoop from the bottom of the







Drawings Showing the Erection Procedure with the Folding Leads

leads. The hammer line is also passed through the folded leads at this time so that it will be ready when the leads have been straightened.

The boom is now raised slowly, allowing the car to roll forward, or the ties supporting the leads to slide on the rail. When the upper section of the leads reached an angle of about 45 deg. with the horizontal, a strain is taken on the pile line and the folding leads are raised clear of the car or ties. Then, by booming up and, at the same time, slacking off on the pile line as the boom is raised, the leads are straightened out, keeping the lower end free of the ground during this operation.

When the leads are in almost vertical position, the pile line is released, the leads are pulled two or three feet away from the crane by hand, and then, by booming down until the leads touch the ground, the upper and lower sections are forced into alinement with the hinges closed. Then the locking pins are placed in the hinges. Next, the strut is raised into place, using the pile line and snatch blocks attached to the leads and boom. In this operation, the end of the pile line is attached to an eye fixed to the strut at its center of gravity. After the strut is fastened in place, the pile line is released, the hammer is hoisted into the leads, and a steam hose is connected to the hammer.

The design and construction of the folding leads was carried out in the work equipment shop at New Haven, by F. F. Zavatkay, Supervisor of Welding and Work Equipment, under the general direction of Col. A. L. Bartlett, engineer, maintenance of way, New Haven, Conn.

Wood Preservation

(*Continued from page* 1050)

placed on the procurement and use of forest products, and the fact that practically no creosote was imported during the year, has been exceeded only twice since 1930 and only six times in the 37 years covered by the record. Solutions of creosote and petroleum consumed 32,044,275 gal. of petroleum, or 1,864,066 gal. less than were used in the preparation of similar solutions in 1944.

The wood-preserving industry also consumed 419,011 lb. of zinc chloride in 1945, which represented a reduction of 252,374 lb. from the amount consumed in 1944. At the same time there was an increase in the consumption of chromated zinc chloride, which rose from 2,165,035 lb. in 1944 to 2,328,006 lb. in 1945, a gain of 162,971 lb. Of these amounts, 15,731 lb. of zinc chloride and 756,960 lb. of the chromated salt were used in treatments for fire retardant purposes.

The consumption of Wolman salts amounted to 732,154 lb., a reduction of 50,102 lb. from the amount consumed in 1944. On the other hand, zinc meta arsenite rose from 11,503 lb. to 17,980, or by 6,477 lb., and a similar increase was reported in the consumption of Celcure, from 105,212 lb. in 1944 to 172,080 lb. in 1945, a gain of 66,868 lb.

In addition to the preservatives that have been mentioned specifically, the wood-preserving industry also consumed 1,348,285 lb. of miscellaneous salts in 1945, compared with 2,315,830 lb. in 1944. This represents a loss of 967,545 lb. Included in the total consumption for the year were 1,030,819 lb. of these salts used in fire-retardant treatments, so that the reduction in the quantity used solely for preservative purposes was relatively much smaller.

The volume of miscellaneous materials used solely or in considerable quantities by the railways for the four-year period ending in 1945, is shown in detail in the accompanying table.

During 1944 there were 236 treating plants in existence in the United States, one more than during the previous year. Of these, 219, or 3 less than in 1944, were active, 13 were idle, 4 plants were constructed during the year, one of which remained inactive, and 4 were abandoned. Of the idle plants, 5 were of the non-pressure (open-tank) type, 4 were designed for pressure treatments, and 4 had facilities for both pressure and non-pressure processes. Of the total number of plants in existence during the year, 192 were commercial plants that treat wood for sale or by contract; 22 were owned and operated by the railways; and 22 were owned and operated by public utilities, mining companies and others to supply their own needs.

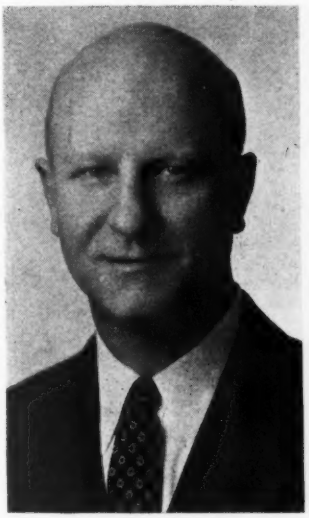
Treatment of Miscellaneous Material—Ft. b. m.

	1945	1944	1943	1942
Lumber	176,339,546	197,613,878	270,525,549	287,191,977
Fence posts	35,874,881	40,319,095	21,255,494	37,401,538
Tie plugs	4,159,079	3,514,076	2,146,370	1,694,468
Crossing Plank	708,448	None reported	None reported	None reported
Car lumber	123,732	183,320	159,792	272,103

Roadmasters' Section

Association "Comes Back" at Chicago Meeting

First full-scale convention in three years, held concurrently with that of Bridge and Building group, proves strength of organization—manufacturers present record exhibit of products



H. E. Kirby
President
Roadmasters' Association

ROADMASTERS and other track maintenance officers who attended the annual convention of the Roadmasters' and Maintenance of Way Association at Chicago on September 17-19 encountered a convincing demonstration of the vitality of that organization. After three years of relative inactivity due to war conditions—the last three annual meetings having been confined to restricted one-day sessions—the association came back to hold a full-scale three day convention this year which ranks as one of the most successful in the association's history by every standard of measurement—attendance, the interest and enthusiasm manifested by those present, and the constructive character of the reports and addresses comprising the program.

Possibly the success of the meeting can be attributed in some degree to the fact that, for the first time in the history of the Roadmasters' group, the annual convention was held concurrently and under the same roof (the Stevens Hotel) with that of the American Railway Bridge and Building Association. Although the two groups held their regular sessions in separate rooms they were brought together at the opening session and on several occasions thereafter to hear addresses on subjects of mutual interest. The two conventions were attended by a total of 693 members and guests. A detailed account of the activities of the Roadmasters' group and of the proceedings during the joint sessions is contained in these pages. A similar account covering the activities of the Bridge and Building group will be presented in the November issue.

The combined opening session of the two conventions on Tuesday morning was presided over jointly by H. E. Kirby, assistant engineer, Chesapeake & Ohio, and president of the Roadmasters' Association, and Neal D. Howard, editor, *Railway Engineering and Maintenance*, and president of the Bridge and Building Association. Later Mr. Kirby and Mr. Howard alternated in directing the activities of the other joint sessions. All sessions of the Roadmasters' group were presided over by Mr. Kirby, assisted by E. J. Brown, engineer of track, Burlington Lines, and first vice-president of the association.

Greetings from Other Groups

During the joint opening session greetings were brought to the combined groups from the American Railway Engineering Association by J. B. Akers, chief engineer, Southern, and president of that association, and from

the Track Supply Association and the Bridge and Building Supply Men's Association by G. B. Coffey, president of the latter association. Mr. Akers spoke of the common purpose of "our associations" and said he liked to think of them "as a team on which we all have a part to play". He expressed confidence that the two associations would foster and support research and development work in their fields. "There are great possibilities", he said, "in these studies, already felt in a large way in improvement in rail, impact on bridges, detection of rail defects, and other subjects. Ties and timbers are certainly susceptible of improvement through study and research. You can advance these studies through your interest and powers of observation."

Also at the opening session Lewis Thomas, secretary of the Track Supply Association and director of exhibits for the two supply groups in arranging a joint exhibition of manufacturers' products that was presented in the exhibit hall of the hotel co-incident with the meetings, extended an invitation to those present to inspect the exhibits. A complete list of the exhibitors, with the names of their representatives present and the products displayed, is presented elsewhere in this issue.

Following the preliminary activities at the opening session, E. M. Hastings, chief engineer, Richmond, Fredericksburg & Potomac, delivered the opening address, after which the two groups separated to begin their individual sessions.

Adressing the Roadmasters' group at the beginning of its first session, President Kirby eulogized his predecessor, E. L. Banion, roadmaster, Atchison, Topeka & Santa Fe, for his loyalty, perseverance and industry in directing the activities of the association during a three-year period while the war was in progress. Noting that much progress had been made since the last meeting in building up the membership of the association, Mr. Kirby, nevertheless, urged the members to do everything possible to secure new members and spoke of the necessity of every member paying his dues promptly. Discussing the problems of the railroads as a whole, he adjured those present to take an active part in any plans or movements designed to improve the lot of the railroads and, conversely, to oppose movements designed to harm them.

Principal elements on the program of the Roadmasters' sessions were the presentation and consideration of six technical committee reports and five addresses, covering a variety of subjects that together comprise a cross-section of the problems confronting maintenance of way supervisory officers today. The six committee reports dealt with the following subjects: Tie Failures and Measures to Overcome Them; Track Maintenance Problems in C.T.C. Territory; Means of Obtaining the Maximum Use of Maintenance of Way Powered Equipment; Minimizing the Need for Slow Orders; Selection and Maintenance of Ballast; and Inspection of Rail by Track Forces.

The five addresses delivered before the Roadmasters' sessions were presented by F. R. Layng, chief engineer, Bessemer & Lake Erie, who spoke on Reducing Maintenance of Way Costs; by G. M. Magee, research engineer, Engineering division, Association of American Railroads, whose subject was—What Size and Design of Tie Plates?; by H. W. Protzeller, consulting engineer, Chicago, who spoke on the Why and How of Ballast Cleaning; by T. A. Blair, assistant chief engineer, Atchison, Topeka & Santa Fe, who discussed Developments in Roadbed Grouting; and T. H. Beebe, chief draftsman, Chicago & North Western, who described the recent installation of 27 pre-assembled units of special trackwork at the Western Avenue crossing at Chicago of the C.&N.W. and the Chicago, Milwaukee, St. Paul & Pacific. Following Mr. Beebe's address, a colored moving picture was presented showing the project which he had described.

E. J. Brown
First Vice-President

F. J. Meyer
Second Vice-President

E. E. Crowley
Treasurer

Addresses at Joint Sessions

In addition, addresses were delivered before joint sessions of the two associations by Major-General Carl R. Gray, Jr., vice-president, C.&N.W., on the "Boys" of Company A; by L. G. Bentley, general safety agent, Chesapeake & Ohio, on How the C.&O. Won the Harriman Gold Medal in 1945; by Donald D. Conn, executive vice-president, Transportation Association of America, on Problems Ahead in Railway Transportation; and by W. K. Wallace, chief civil engineer, London, Midland & Scottish, on Reconversion and Recovery Problems on the British Railways.

Mr. Wallace, who is heading a mission of engineering officers from his road to study railroad maintenance and engineering practices in this country, discussed the magnitude of the problem encountered by his company in overcoming arrearages in track maintenance accumulated during the war years, and the methods being

Roadmasters' Association

Officers 1945-46

H. E. Kirby, president, assistant engineer, C. & O., Richmond, Va.

E. J. Brown, first vice-president, engineer of track, Burlington Lines, Chicago.

F. J. Meyer, second vice-president, formerly chief engineer, N.Y.O. & W., Middletown, N.Y., and now chief engineer, Railway division, Philadelphia Steel & Wire Corp., Philadelphia, Pa.

Elise LaChance, secretary, Chicago.

E. E. Crowley, treasurer, roadmaster, D. & H., Albany, N.Y.

Directors

Ray Marshall, district roadmaster, G.N., Superior, Wis.

R. L. Fox, division engineer, Sou., Alexandria, Va.

A. L. Kleine*, trainmaster, D. & R.G.W., Alamosa, Colo.

F. G. Campbell, assistant chief engineer, E.J. & E., Joliet, Ill.

A. B. Chaney, district engineer, M.P., Little Rock, Ark.

A. G. Reese, district maintenance engineer, C.B. & Q., Galesburg, Ill.

C. Halverson, division roadmaster, G.N., Willmar, Minn.

J. E. Fanning, assistant to chief engineer, I.C., Chicago.

*Deceased.

employed, and also related the situation as it applies to structures, not only because of deferred maintenance, but due to war damage as well. Developments in this respect include the extensive use of pre-stressed, precast concrete members, and the introduction of a unit form of construction for the smaller passenger stations. Mr. Wallace's address was followed by the showing of three moving pictures depicting various maintenance and construction practices in use on his road.

Published in full in the following pages are the addresses by Mr. Blair and Mr. Layng and the six committee reports, the latter being accompanied by condensed versions of the discussion following their presentation. Also included are abstracts of the addresses by Messrs. Hastings, Gray, Bently and Conn. The addresses by Messrs. Magee, Protzeller and Beebe will be published in subsequent issues.

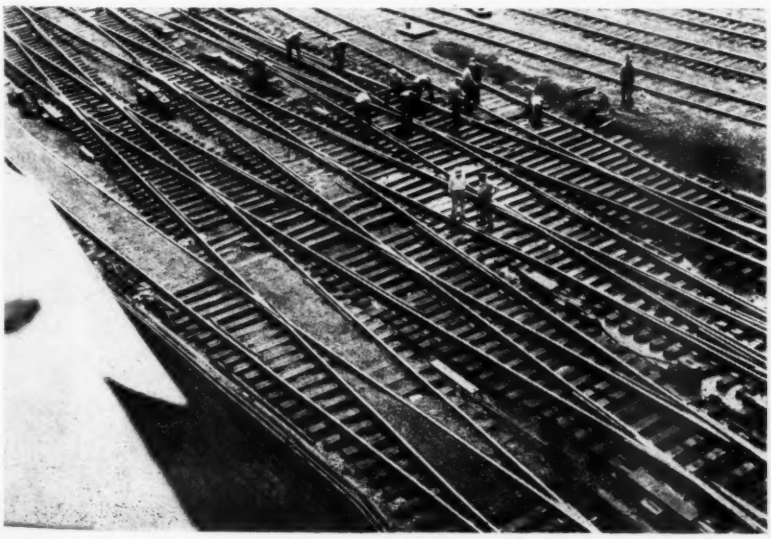
The regular activities of the convention were interspersed at times with a number of special events. One of these was the presentation of honorary membership certificates to the four honorary members who were elected to this capacity at last year's meeting, these including Major-General Gray; Herbert R. Clarke, chief engineer, Burlington Lines; Charles W. Baldridge, assistant engineer (retired), Atchison, Topeka & Santa Fe System; and William H. Sparks, general inspector of track, Chesapeake & Ohio. The presentation of these certificates was made by George M. O'Rourke, assistant engineer maintenance of way, Illinois Central.

Another special event was a banquet on Wednesday evening, September 18, which was tendered to members of the two associations and their families by the Track Supply Association and the Bridge and Building Supply Men's Association. The banquet was attended by a total of 857 persons. A third special event was an inspection trip, made on Thursday afternoon and attended by about 50 members of the Roadmasters' group, to the Western Avenue crossing of the C.&N.W. and the C.M.St.P.&P. to inspect the 27 units of special trackwork that had been described previously in Mr. Beebe's address.

New Officers

In the election of officers at the final session on Thursday, E. J. Brown, engineer of track, Burlington Lines, Chicago, was advanced from first vice-president to president; A. B. Chaney, district engineer, Missouri Pacific, Little Rock, Ark., was elected first vice-president; R. L. Fox, division engineer, Southern, Alexandria, Va., was elected second vice-president; and E. E. Crowley, roadmaster, Delaware & Hudson, Albany, N.Y., was elected treasurer. A. H. Whisler, assistant engineer, Pennsylvania, Philadelphia, Pa., was elected a director to fill the unexpired term of Mr. Chaney, terminating in 1948, and N. D. Howard was elected to fill the unexpired term of the late A. L. Kleine, terminating in 1947. Directors elected for full four-year terms were R. H. Gilkey, division engineer, Central of Georgia, Savannah, Ga., and Henry C. Koch, roadmaster, Belt Railway of Chicago, Chicago.

Six subjects were selected at the meeting for investigation by technical committees during the ensuing year.



Working on the Installation of the 27 Units of Special Trackwork at the Western Avenue Crossing at Chicago of the C.&N.W. and the C.M.St.P.&P.

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These are as follows: Advance Preparation of Track for Rail Renewals; Methods of Increasing the Production of Extra Gangs; Roadmaster's Responsibility in Controlling Maintenance of Way Costs; Safety in Operation of Motor Cars and Work Equipment; Installation and Maintenance of High-Speed Turnouts; and Development and Training of Track Foremen. The report of the secretary indicated that the association has a total of 651 members in good standing, including 482 active members, 105 associate members, 33 life members, 7 honorary members, and 24 members in military service.

Meeting separately after the adjournment of the conventions the newly-elected Executive committees of the two associations voted to hold the conventions simultaneously again in 1947 during the week of September 15.

Hastings Looks Ahead

"THIS day should be a red letter day in the history of these two organizations of railway men—the American Railway Bridge and Building Association and the Roadmasters' and Maintenance of Way Association," said Mr. Hastings in his address before the joint opening session, who continued in part as follows:

"The bringing together of these two groups indicates to me more forcefully than before how interwoven are our interests and how dependent we are upon each other in advancing the interests of the whole railway field. These two associations that you represent should work hand in hand and by every endeavor strive to knit more closely the fabric that forms the garment for the entire railway structure.

"During the months that are now behind us we spent both our substance and ourselves in one grand effort to defeat our enemies, provide help for our allies, and keep our own 'powder dry,' by making our railroads the arteries through which the very life blood of our Nation was flowing. Now the guns are silent, and we turn again to paths of peace, with added responsibilities for rehabilitation and improved service to the public, which is an exacting service. However, past performances are soon forgotten—the public lives in the present—it wants to know, What

have you now?, not what you have done, not what you may do at some far distant date, but what are you doing?

"In Nation's Business for September there is a full-page advertisement of the Association of American Railroads which presents some facts that all should know. For the first six months of 1946, for each dollar of revenue received the railroads paid out more than a dollar, distributed in this way—for wages, 53.1 cents; for materials and fuel, 25.1 cents; for other operating costs, 10.0 cents; for taxes, 7.5 cents; for interest, rentals and other fixed charges for the use of capital, 5.0 cents—total, 100.7 cents. Wages, the largest single item in railroad costs, average 53 per cent more than they were just before the war. Prices of materials, supplies and fuel are up 47 per cent. The cost of capital has been going down.

"In the face of these rising operating costs we must maintain our properties in better condition and prepare for higher speeds and greater safety, with economy as our watchword. Every means that can be devised should be used to reduce operating and maintenance costs and to increase safety and efficiency. This is a 'must' for the railway industry, which still stands out as a bulwark of private enterprise in the face of constantly growing public utilities that will soon have us surrounded and engulfed unless we accomplish the task ahead in spite of the obstacles placed in our way.

Unfair Competition

"We know of vast expenditures being made from the public purse, and still greater expenditures being planned, calling for millions upon millions of the taxpayers' money, to provide more and greater highways; longer and deeper waterways, even to the extent of cutting canals where natural waterways do not exist; tax-financed airports in every village, town and city—all these to be in competition with your railway and mine, while our companies finance, build, maintain, operate and pay taxes on the property created out of private capital—taxes that help pay for part of the public utility that becomes our principal competitor. Thus, all of the ideas of fair play, one of the fundamental principles of our Americanism of the past, are seemingly cast to the winds. Are you disturbed or worried about the situation? You should be. Let your voices be heard, your ideas known, your influence felt, and we shall yet overcome the obstacles and keep our rightful place in the transportation industry."

Gray Tells About "Boys" of Company A

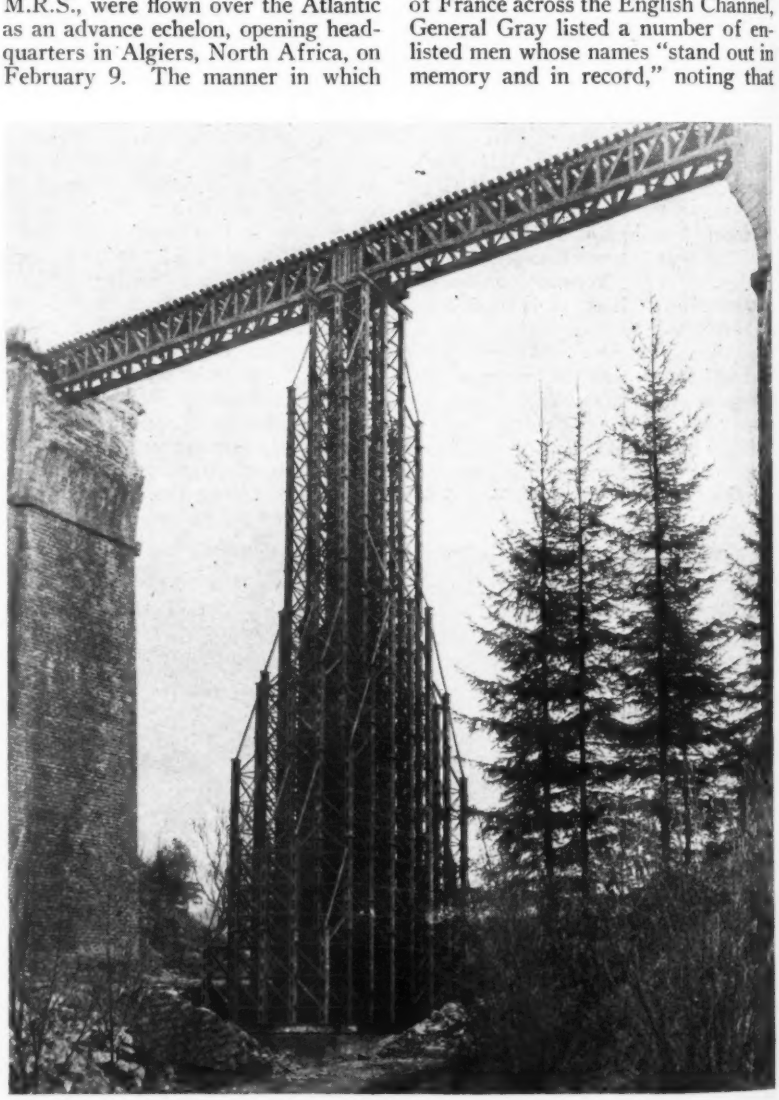
IN HIS address on The "Boys" of Company A, Major-General Gray first outlined the organization and functions of the Military Railway Service and then proceeded with a detailed analysis of the organization, duties, personnel and equipment of the A Company of a Railway Operating Battalion, this company being equivalent to the maintenance of way department in a division superintendent's organization.

History Traced

General Gray then traced the activities of the Military Railway Service from February, 1943, when 25 officers and men of headquarters, First M.R.S., were flown over the Atlantic as an advance echelon, opening headquarters in Algiers, North Africa, on February 9. The manner in which decisions were made and priorities issued for railway lines to be rehabilitated and operated by the M.R.S. was described. Pointing out that the reconstruction of demolished bridges was the principal task confronting the A companies in North Africa, General Gray described some of the problems faced and the methods used.

Regarding operations in Italy, General Gray said that, from the fall of 1943 to the summer of 1944, the A companies and assigned troops rebuilt over 1,000 miles of track, constructed more than 15,000 ft. of new bridging, and reconstructed 24 tunnels with a total length of 20 miles. Next, he gave essential information regarding some of the more interesting bridge reconstruction jobs carried out in Italy, France and Germany.

After discussing the work performed by A Company troops of the Second M.R.S. following the invasion of France across the English Channel, General Gray listed a number of enlisted men whose names "stand out in memory and in record," noting that



How the Military Forces Restored a Railroad Bridge in France

"he could, and possibly should, name every man" if time permitted. "The American railroad man," he concluded, "is without doubt the best in the world, and the A Company men of the American Army's Military Railway Service were the finest construction and maintenance men the world has ever seen or ever will see."

C.&O. Safety Record Explained by Bentley

THE essential qualifications of good supervisors and foremen, particularly those that are necessary if the men under them are to be safe workers, constituted the first item discussed by Mr. Bentley in his address on How the Chesapeake & Ohio won the Harriman Gold Medal in 1945. Proceeding with an outline of "some of the activities embraced in a good safety program" he mentioned the need for a general safety agent to direct all safety activities, and for supervising safety agents to assist him in the field, describing the functions of the latter in some detail, and how they contribute to the safety program.

Program on C.&O.

Other measures described as constituting elements of the safety program on the C.&O. included the use of safety committees "everywhere" on the railroad; the issuance of a book of safety rules, which was developed when it was found that 95 per cent of injuries was caused by improper acts of employees; employment of the competitive spirit by means of departmental safety contests, including an annual safety conference for the award of trophies; a safety contest set up by the chief engineer and arranged by the supervisors under his jurisdiction; a system for recognizing the efficiency of foremen in preventing accidents among their men; and the issuance of weekly safety bulletins in the maintenance of way department, a plan that was started on January 1, 1945.

Mr. Bentley also discussed the percentage of train accidents caused by defects in or improper maintenance of way and structures, the use of goggles and safety shoes, and the investigation of accidents by committees. Reviewing the safety record of the maintenance of way, bridge and building and engineering departments of the C.&O., he said that, while in 1945 these departments had 23.5 per cent of the man-hours on the railroad, they suffered only 15 per cent of the injuries.

Private Enterprise Endangered, Says Conn

THE initial sentence—and the theme—of Mr. Conn's address on Problems Ahead in Rail Transportation was this: "Fundamentally, the one problem before the United States in rail transportation—in all transportation—is the preservation of the industry in private ownership." Stating that he is convinced that if "we do not soon consummate policies that will preserve the common-carrier industry in private ownership, there may be no private industry left in the United States"; Mr. Conn declared that leaders of state socialism are following a definite program "in their attempt to discredit and undermine the principle of private enterprise", and pictured vividly the evils that would result if these efforts are successful.

Mr. Conn then described the present policies and principles of regulations that he feels will lead inevitably to government ownership of the transportation industry unless arrested, these including conflicting federal statutes and opposing policies of

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regulations; the policy of the government in promoting direct competition between its capital, *which need earn no return,* and private capital, *which must earn a return;* restrictions and prohibitions on the several forms of transportation regarding the ownership or operation of other forms of transportation; and the effects of a large volume of transportation business being handled by shippers and producers for their own account.

After presenting a series of recommendations for congressional action, which are designed to correct the situation, Mr. Conn said that, "if private ownership is to prevail, national policies must result in a system of competitive agencies in which the gross revenues of each, derived from the lowest possible basis of individual rates, will leave a net return sufficient to attract private capital on terms no less favorable than those enjoyed by other major industries."

New Developments and Trends in Roadbed Grouting

By T. A. Blair
Assistant Chief Engineer,
Atchison, Topeka & Santa Fe
Chicago

THERE have been no major developments in roadbed grouting during the last year. Additional miles of track have been grouted, and we have a further history as to the ability of grouted roadbed to stand up and of the economies resulting from grouting. About 500 miles of track have now been grouted in the United States. The initial test of roadbed grouting was made on the Pennsylvania, and it now has a history of 10 years without failure. Also, we now have a history of several miles of grouting which have been installed four years.

Roadbed grouting, except for a few failures, has resulted in major savings in the cost of maintenance and in the elimination of slow orders. Most of the failures have been corrected by regrouting, and in general they resulted from not going deep enough with the grout points. There have been a few cases where grouting has not been wholly successful, due to grouting ballast on recently constructed line changes where the ballast has not penetrated deep enough into the subgrade to permit sufficient grout to be accepted to give complete stabilization.

Grouting was originally used for curing soft track resulting from water pockets, and is still largely used for this purpose, but in the last two years many miles of track have been grouted which did not show the typical water pockets. This track was constructed on plastic clay, which dried out and shrunk during dry seasons, producing large cracks in the subgrade under the ballast, which resulted in rougher track during dry periods. By inserting grout points in the ballast section, the fouled portion of which furnishes an umbrella to hold the grout, it is possible to fill these cracks with grout with the result that, when moisture again contacts the roadbed, soil pressures are built up owing to the fact that the clay cannot now expand, so that the formation of further cracks is prevented. A large number of slides, on both side hills and embankments, has

been grouted with universal success.

Several manufacturers have completed test models of grouting machines during the last year. These machines will be ready for delivery next year, and each railroad should be able to purchase equipment that will best serve its particular conditions.

A great deal will be heard about the two schools of thought in grouting practice—the rich grouters and the lean grouters—but I do not think this need cause concern since it will be the materials available, the type of roadbed to be grouted, and the money in hand that will probably dictate which of these schools each man will join. To date there have been no failures that would indicate that either of these systems is to be preferred. It appears that the essential requirement of the grout mixture is that it be the easiest pumping mixture to the end that the pumping pressures will be as low as possible. Recognition of this fact has led to the the use, where available, of fine blow sand and admixtures such as emulsified asphalt and fly ash.

Savings resulting from grouting have been reported by all the railroads using this process, with the annual savings in maintenance expense running from 8 to 10 times the cost of grouting where short critical pockets are concerned, to an annual saving of one-half the cost of grouting where stretches of one mile or more are concerned.

Discussion

An extended discussion followed the presentation of this paper, the largest part of which related to the nature of the equipment used and the means of operating it, together with the organization required. It was brought out, however, that the Santa Fe has to the present time grouted 360 miles of roadbed at an average cost of 60 cents per foot of track, and that this cost is divided almost uniformly, 2/3 to labor and 1/3 to material. Mr. Blair explained that asphalt is introduced into the grouting mixture because it appears to act in a measure as a lubricant, with the result that the grouting can be done with about half as much pressure on the pumps as when the asphalt is left out of the mixture. He also stated that fly ash normally has the same effect as the asphalt, that is, to hold the pump pressure well below the level that must be maintained without this admixture to obtain the desired penetration.

Means of Obtaining the Maximum Use of Maintenance of Way Powered Equipment

Report of Committee

A. H. Whisler
Chairman

THE subject of how to obtain the maximum use of powered equipment is one of the most important facing the maintenance of way officer, since such equipment has come into general use in practically all phases of his every-day problems. That the importance of this is not generally realized is evidenced by the apparent lack of co-ordination necessary by those in authority to secure the best possible results with powered equipment, or results that will attract favorable comment.

In the assignment of powered equipment, sub-division, division or regional limits must disappear and sub-department or departmental ideas must be forgotten. The distribution of powered equipment should be handled by a grand division, regional or even a system organization. Many roadmasters, supervisors, division engineers, etc., will not agree to such an arrangement, especially those with an obsession that they should keep a piece of equipment, even though it must lie around idle a large part of the time, simply because they might have use for it in the future.

No definite rules can be formulated for doing each class of work in one and only one manner. Each particular job, including its location, size and other factors, should be considered, and a definite procedure for handling it should be decided upon before the work is started. Lack of such a carefully-organized procedure, based on thoughtful planning, will be reflected in the actions and quality of work by all concerned, and will result in discouraging costs.

During the recent war years, acute shortages of man-power to maintain, and even expand, railroad facilities were the principal argument used in requesting machines to carry our work programs. This reason, we hope, is now as outmoded as we like to think war is.

Three Considerations

We must now face our problems involving the use of maintenance equipment with the idea that the most important questions are:

(1) How does the quality of work performed by powered equipment compare with that performed by hand methods?

(2) Does the cost of doing the work with powered equipment compare favorably with that performed with only hand tools?

(3) Is there sufficient work to be done to warrant the investment in the machine in question?

While the first question will not result in varied opinions, the second can result in endless argument unless cold facts and figures are faced and work programs are made and carried out judiciously.

The programs of work to be done must indicate the amounts of work to be done at various locations, and only by careful planning of details can this work be done in a most efficient and economical manner.

Since there are few, if any, records available whereby the capacities or performances of the various types of roadway machines in various locations, under varying conditions, can be determined, it is necessary to consider how much actual working time per day a machine will have in each location; how much interference will be had from traffic; how much preparation time will be given to the operator to lubricate, adjust and clean his machine properly. Consideration must also be given to how many days a machine can be expected to be idle on account of weather conditions; how many hours it can be expected to be out of order for the replacement of parts, or supposedly "broken-down" while a poor-grade operator is waiting for a repairman to put it back into service with a few minor adjustments.

The use of track charts to a scale of a thousand feet per inch, indicating by vari-

ous colors the different items of work programmed and the machines that will be used to perform the work, by their assigned numbers, can be made most interesting and to result in the most efficient assignment of work equipment. The use of such charts as progress charts will readily emphasize weaknesses in the organization and the assignment of defective or wrong types of machines. Properly publicized, they will create a competitive spirit that will speed up and improve the quality of the work.

Proper Machines Important

The use of the proper type of machine is very essential if operating costs are to be a source of satisfaction. For example, when a crane is required to perform certain work, it must be determined whether a highway-truck crane, a crawler-mounted crane, a locomotive crane, or a boom mounted on the rear of a crawler tractor, is the proper machine. The use of one type when another type should be used can easily result in costs greater than when performing the work with hand labor.

Careful consideration should be given to the various classes of work that can be done with a machine without special attachments, and to how many additional classes of work can be performed by the same machine with the addition of one or more attachments.

A crawler tractor equipped with an angle-dozing blade, rear-end power winch and moderate length boom can be used regularly in grading or drainage work, and in emergencies, such as at derailments or wrecks, will prove most valuable in clearing the subgrade of twisted and tangled track, spilled mineral lading, trucks of wrecked cars, etc.

The automobile truck to transport track, bridge and building and signal gangs between their headquarters and points of work, replacing a track motor car, can frequently be used to turn many unproductive man-hours into productive hours. Where physical characteristics of the country are such that the auto truck can be used only in one direction, to or from the scene of work, and track motor cars must be used in the other direction, the application of rail-highway equipment to the auto truck may be the means of effecting the savings desired.

Use of Machines

Work should be programmed to provide for the use of the maximum number of machines on each job, with each type of machine lined up in the proper sequence. For example, one foreman can direct the operation of six or eight power wrenches in out-of-face bolt tightening operations just as effectively as two such machines, and the transportation of fuel and supplies for the larger number of power wrenches can be accomplished just as cheaply as it can for one or two machines. The concentration of a number of machines on the same job will also cause a certain amount of rivalry in the gang, with the result that more work will be done per unit.

When several kinds of machines are used on one job, an insufficient number of any one kind, or failure of a machine, may prevent the progress desired. For example, if 2 power wrenches to remove track bolts, 4 spike pullers, 4 tie adzers, 1 rail crane, 2 power wrenches applying track bolts, 4 tie borers, and 1 air compressor with 6 spike driving guns are being employed in the order named in rail renewals, it can be readily seen how the failure of one machine to perform its assigned share of the work will upset the normal progress of the operations.

Machines should be used in proper sequence. If this is done, such as the use of ballast cleaning and rail cross-cutting units prior to the start of power tamping equipment, it will eliminate any contention or concern that one machine adversely affects the work done by others.

Moving Machines

The moving of machines from one job to another must also be given careful thought. This should be done in such manner that the machines will not be damaged, and when it will result in the least loss of programmed working time. The best time to move a machine is just after its tour of duty on a particular job so that any delays in the movement or in preparing the machine for the new work will not run into its normal working hours on the new job.

Must Be in Good Order

The efficient operation and lasting qualities of all roadway machines determine their dependability and popularity. Old machines should be given a genuine reconditioning or overhauling, and new machines should be properly run-in before they are assigned to the charge of an operator. A machine delivered for work with even a minor defect will have an injurious effect on the attitude of the operator and others working with it. All repairs in the field should be made with parts and supplies procured from a centrally located shop or storehouse, and everyone should be required to refer to parts by the numbers listed in the manufacturer's parts lists, and to the machines by the railroad's machinery record numbers and the manufacturer's serial numbers.

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Qualified Operators

Thoroughly trained and properly qualified operators are necessary in securing the best performance of machines. It is essential that they have intelligence, sound judgment, an eagerness to learn, and some mechanical knowledge. A machine may be in the best of condition when it leaves the shop, yet be ruined by an inexperienced or careless operator in a short time, disrupting the work of an entire organization. We all know this from experience. Whenever possible, operators should be encouraged to spend some time in the repair shop when machines are being overhauled. This will educate them in the construction of the machines and will afford them an opportunity to learn how to make minor repairs themselves.

Operators should be taught the importance of keeping their machines well oiled and greased. Work should be programmed to allow them to lubricate and clean their machines properly each day. Much time is lost when machines are first received if those who are to operate them are unfamiliar with their operation. Better results will be obtained if a machinery repairman, or at least one who is familiar with the machine, is required to accompany the machine to its new location to instruct the new operator in its operation, care and maintenance. Instruction schools for operators, usually in the wintertime, also have proven of value, and tend to attract a better class of men for machine operators.

Machines Should Be Handled Carefully When Being Moved

Another factor that has entered into the carrying out of maintenance of way work with power machines is the demands of train and enginemen that they be used on self-propelled roadway equipment to crew the machines. The overloading of self-propelled machines by non-essential employees has not only greatly increased the cost of work, but has defeated the technological advancement made as the result of such equipment to the point where some carriers are reluctant to purchase on-track machines.

When work programs are prepared prior to the start of the various working seasons, consideration must be given the machines marketed during or since the last working season.

In conclusion, the only way to construct, rebuild or maintain railroad facilities in the most economical and otherwise satisfactory manner is to give the most careful consideration to all of the details of the work to be done and to the equipment best suited to perform it.

Committee Personnel

A. H. Whisler (chairman), asst. engr., Penna., Philadelphia, Pa.; G. B. Aydelott (vice-president), trmstr.-rdm., D.&R.G.W., Gunnison, Colo.; J. S. Anthony (vice-chairman), trk. supvr., Sou., Gastonia, N. C.; F. G. Campbell, asst. ch. engr., E.J.&E., Joliet, Ill.; M. D. Carothers, ch. engr., Alton, Chicago; F. A. Chinquist, div. rdm., G.N., Grand Forks, N.D.; James T. Flynn, George M. Hogan & Co., Chicago; J. C. Jacob, div. engr., I.C., Jackson, Tenn.; A. R. Kastella, G.N., Whitefish, Mont., G. M. O'Rourke, asst. engr., m. of w., I.C., Chicago; J. J. Mitchke, G.N., Everett, Wash.; T. F. Scholes, supvr. trk., L.I., Jamaica, N.Y.; R. H. Smith, vice-president, N.&W., Roanoke, Va.; J. S. Vreeland, sales repr., Simmons-Boardman Publishing Corporation, New York; Charles Weiss, supvr., Penna., Valparaiso, Ind.; F. B. LaFleur, rdm., T.&N.O., Lafayette, La.; G. L. Glover, supvr. trk., N.Y.C., Niles, Mich.; J. R. Rushmer, rdway. engr., A.T.&S.F., Amarillo, Tex.; and E. L. Banion, A.T.& S.F., Topeka, Kan.

Discussion

E. J. Brown (C.B. & Q.) commented that the report was most timely since it followed the address made on Tuesday by F. R. Laying (B. & L.E.), who stressed the importance of increasing the productivity of the track forces by the full use of machines.

In reply to an inquiry by L. T. Nuckols (C. & O.), Chairman Whisler stated that rail laying on the Pennsylvania is carried out by regional organizations, fully mechanized and housed in camp cars, working under the direction of the regional chief engineers maintenance of way. He added that the best results have been obtained with a gang of 115 to 125 men.

Armstrong Chinn (Alton) inquired if any records were available to show the output of mechanized rail gangs compared with non-mechanized gangs. To this, Chairman Whisler, saying that he did not have figures readily available, expressed confidence that the mechanical method was by far the most efficient. Mr. Chinn then pointed out that, since the recent wage increases, the track laborer is the most costly single item in maintenance work, and that it is necessary to give him power tools to increase his production to offset the increased costs. E. L. Banion (A.T. & S.F.), pointing out that cost is not the only factor to be considered, referred to the better quality of the work done by machinery compared with hand methods, citing adzing as an example. He also called attention to the greater safety to be attained in mechanized work.

Selection and Maintenance of Ballast

Report of Committee

H. W. Kellogg
Chairman

BALLAST is a very important item in securing good track and assuring economical maintenance. The primary functions of ballast are: (1) To transmit the load from the track structure to the subgrade as evenly as possible; (2) to hold the ties in place; and (3) to drain water away from the ties. It follows from the purposes for which ballast is used that the ideal ballast would possess the following properties: (1) Retain no water; (2) offer maximum friction to movement of the ties; (3) not disintegrate under the action of traffic or tamping; (4) be easily worked; (5) be free of dust; and (6) retard vegetation.

Selection of Ballast

Many different factors and circumstances affect the choice of material for ballast. It is highly desirable that ballast be suitable for the type and density of traffic to be handled. Ballast which is satisfactory for light-traffic lines may be entirely unsuitable for heavy, high-speed traffic. The kind of ballast used will have a marked effect upon maintenance costs. However, consideration must be given to the proximity of the source of ballast to its point of application. To reduce transportation costs, it is always desirable to have as short a road haul as possible and to keep to a minimum the number of cars required to take care of a ballast job.

It may frequently happen that a better grade of ballast hauled a greater distance will prove more economical than a cheaper, inferior ballast obtainable nearby. On the other hand, savings in overall costs may often be effected by using a lower grade ballast procurable locally than to use a higher grade involving a long haul, as it has been demonstrated that good track can be maintained on several types of more or less inferior grades of ballast. Emphasis should be placed on the fact that such decisions require analysis of all the factors to determine the relative economy, as well as careful study to determine the proper ballast section to be used.

The materials most commonly used for ballast are crushed stone, washed gravel, bank-run gravel, torpedo gravel, slag, chats, cinders, and sand.

Ballast Sizes

Ballast produced for use on main lines is generally governed by standard specifications, although specifications vary between roads for the same types of ballast. The most common size of stone used is that known as 2-in. stone. Good results can be obtained, however, by using 1½-in. stone or even 1-in. or ¾-in. sizes, and in many instances the smaller sizes are favored. Likewise, specifications covering washed gravel vary on different roads, particularly as to the percentage of crushed material and round stone. It is very desirable that the gravel contain a large volume of crushed stones. Otherwise the ballast will not hold the ties in place under high-speed traffic, and increased maintenance costs will result.

The ballast generally considered best for high-speed main-line traffic is crushed stone, which should be as nearly uniform as possible, and of a maximum size of 2-in. It should also have sufficient hardness to resist pulverizing under tamping and traffic, and be of such quality as to withstand the elements. In the application of stone ballast to track that has been previously ballasted with other material, the track should be stripped and given a

lift sufficient to insure uniform distribution of the load on the subgrade. This should be done in two operations. During the first raise the track should be brought to proper grade and then shovel tamped. After a suitable interval, during which time the track should be allowed to settle under traffic, the track should again be lifted to proper grade and machine tamped. After another interval the track should be gone over by a small surfacing force to correct any slight irregularities in line or surface.

Where there is any fine, sharp material in ballast, care must be used to keep the ballast down at least to the level of the tops of the ties on high speed lines; otherwise high-speed equipment will pick up the fine material and deposit it on the rails and on the understructure of the equipment, causing it to act much as a sand blast, and in some cases causing damage to the equipment and track. Crushed stone, washed gravel and slag should be dressed down about two inches below the tops of the ties, with a shoulder approximately six inches in width outside the ends of the ties before the ballast is sloped down to the berm.

Regular Inspections Should Be Made of Ballast as Unloaded

After the selection of the kind of ballast to be used, the responsibility of the maintenance officer in charge of the work is to make regular inspections of the ballast as unloaded from cars to see that it conforms to specifications. This may be done by taking samples of the material, or close visual inspections may be sufficient.

Maintenance of Ballast

When suitable ballast has been unloaded and the track placed in proper line and surface, it then becomes the duty of the maintenance officer to maintain the ballast in such a way that he will continue to have smooth-riding track. This may best be done by giving close attention to the matter of keeping the ballast clean. Where ballast has become fouled by reason of mud coming up through it from the roadbed, or by foreign matter falling upon it, water will not drain away. The result invariably will be pumping joints and rough track.

Track newly ballasted with stone or hard slag and properly put up should, under normal conditions, require a minimum of surfacing for a considerable period, after which an occasional out-of-face surface lift of about two inches may be given and the necessary tie renewals made. In most instances this latter work requires the use of very little additional ballast. It is a practice, however, that cannot be followed in all cases.

The topography of the railroad, type of traffic, kind of subgrade, and other factors have a direct effect on the condition of the ballast. On heavy grades, cinders, engine sand and material spilling out of cars will tend to foul the ballast. In places where the subgrade is principally clay, this material tends to work up into the ballast, especially on the low sides of curves. When these conditions occur, the only alternative is to clean the ballast.

Cleaning Ballast

There are several methods of cleaning ballast. For spot work the simplest method is to break out the caked ballast with hand picks or mechanical cribbing forks. The ballast is then removed from the cribs outside of the rails, and from inside the rails if necessary, which may be done with shovels, or by means of a special cribbing bucket which is pulled through the cribs by a winch mounted on a small crawler tractor. The ballast is then screened with forks and thrown back into the cribs.

Some railroads have utilized large ballast-cleaning machines which require the use of a locomotive and work train, while other roads use off-track "moles," or use both on different sections of the road. The "mole," which cleans the ballast beyond the ends of the ties, is a development of the tendency toward the use of off-track equipment for maintenance work. Both types of machines do a successful and economical job.

In maintaining washed gravel ballast, cleaning is not recommended as in the case of stone or slag. After main-line track newly ballasted with washed gravel has been run over for a period of five to seven or eight years, depending on the traffic, the trackmen begin to experience difficulty in maintaining smooth track with ordinary spot surfacing. This track should be then given a two or three-inch lift, necessary tie renewals made, and new ballast added as needed. When possible to obtain, a small amount of ¾-in. crushed stone mixed with the gravel produces excellent results. Due to subgrade and other varying physical conditions, no track will show the same deterioration of the ballast throughout a given stretch or subdivision, and in places the ballast will be found caked to the approximate consistency of concrete. Such spots should be stripped and fresh gravel added. One place where this condition occurs most frequently is at road crossings, where, in some cases in open country, it has been found practical to lift the track about twelve inches and have the highway department build up the highway approaches to the new railroad grade.

Disc Some Track

On secondary lines where traffic is not heavy, tracks ballasted with washed gravel and bank-run gravel can be maintained by track forces for many years with ordinary spot surfacing, providing proper attention is given to drainage. On track of this type the ballast shoulder tends to become crushed, causing the water to be sealed around the ties. A ballast-discing machine operated over this kind of track once or twice each year will help keep the ballast loose and porous, and will also retard the growth of vegetation. Cinder ballast, torpedo gravel and other types of ballast used on branch lines may be maintained successfully in the same manner as bank-run gravel.

In conclusion, it may be stated that the large expense of track surfacing, which on some roads amounts to 50 per cent of the total maintenance labor expense, may be greatly reduced by selecting the proper ballast, after considering all of the factors involved, and by giving close attention to the matter of keeping the ballast clean.

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ROADMASTERS

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Discussion

The discussion of this report dealt in part with the difficulty that is apparently being encountered on some railroads in maintaining track on ballast-deck bridges to the proper line and surface. Explaining the practice on his road, chairman Kellogg said that some difficulty of this nature had been encountered where crushed stone ballast containing relatively large particles was used. As a result, ballast having a maximum size of 1½ in. was adopted. Chairman Kellogg also stated that ¾-in. ballast had been used on ballast-deck bridges, and he expressed the opinion that ballast of this size would probably give the best results.

In another phase of the discussion it developed that various railroads are having difficulty maintaining track to good line and surface that is ballasted with washed gravel from which all fines have been removed. E. L. Banion (A.T. & S.F.) reported that this difficulty had been overcome successfully on his railroad by mixing a certain proportion of sharp washed sand with the gravel.

Minimizing the Need for Slow Orders

Report of Committee

J. C. Jacobs
Chairman

THE primary purpose of any railroad is to provide fast, safe and dependable transportation service. The tendency since the first World War has been toward higher speeds of both freight and passenger trains, and the carriers are now entering an era in which they may expect demands for service that will, of necessity, require many of their more important freight trains to operate on what, in the past, would have been considered passenger train schedules. Furthermore, it can be expected that passenger train speeds of 90 to 95 m.p.h. for steam equipment, and upwards of 100 m.p.h. for Diesel equipment, will not be uncommon.

On-time performance will be required if the increasing competition from the airplane, bus and truck is to be met. To maintain the high standards of service that will be demanded is the responsibility of every railroad employee and some of the greatest responsibilities in this respect lie with those in the maintenance of way department, for they are the ones who must maintain the tracks in proper condition for the higher speeds which may be expected soon to become commonplace. Any condition which requires either a temporary or permanent speed restriction handicaps the operating department in maintaining fast schedules, and the responsibility for keeping such conditions to a minimum rests principally with the maintenance of way department.

Lost Train Time

Slow orders, primarily, are train orders which restrict the speeds of trains at specified locations because of the existence of conditions which prevent safe operation at normal speeds. Frequently these are of a more or less permanent nature which cannot be remedied readily, and which required reduced speed over a long period of time. Such restrictions are usually covered by bulletin or special instructions in the timetable, and technically are not slow orders, but since they have a similar effect on train performance, they are, in a broader sense, slow orders, and will be so considered in this report.

If fast schedules are to be maintained on districts where a number of slow orders exist, it is often necessary that trains be operated at excessive speeds between the restricted sections. Such bursts of speed tend to damage the track and equipment. Restrictions which materially reduce the normal speeds of trains, particularly those which call for speeds as low as 10 or 15 m.p.m., are very expensive, not only from the standpoint of time lost, but also from that of fuel consumption and wear and tear of equipment. When the speed of a train is reduced from 60 m.p.h. to 20 m.p.h., a very considerable amount of time and fuel is consumed in regaining normal speed. Under some circumstances, a fast or heavy train may require as much as 20 to 30 miles to attain top speed, and a drastic restriction on such a train, even for a short distance, can easily cause a delay which cannot be made up.

Classifications

Slow orders, or restrictions, as treated in this report, fall largely in three classifications:

First—permanent restrictions because of curve conditions, junction turnouts, light or worn rail, bridges, etc.

Second—permanent or semi-permanent (often seasonal) restrictions because of unstable roadbed, soft spots, danger of sliding fills, cuts, etc.

Third—temporary restrictions account of rail renewals, ballasting, surfacing, bridge renewals, bad-riding track, heaving track, floods, severe storms, and other emergencies.

The conditions listed in the first classification generally require capital expenditures to correct, and each case should be considered on its merits to determine whether the expense of correction will be justified by the results to be obtained.

The conditions listed in the second category can generally be corrected, and while the cure is often expensive, there are many cases which can be remedied at moderate cost, and in the majority of instances the results will fully justify the cost if the district is one on which the maintenance of schedules and the elimination of restrictions are important. The problem presented by sliding fills can generally be solved by the use of slide piling, the proper placing of perforated drain pipe, or a combination of both methods. Berm ditches or drain pipe will often stop sliding cuts, while sub-drainage, pressure grouting, or the driving of posts will generally correct soft spots. The remedy in each case should be decided upon only after a careful study of the conditions on the ground.

Common Causes of Orders

The operations listed under the third category are probably the cause of more train delays due to slow orders than all of the conditions in the first and second classifications combined, and, therefore, offer the greatest opportunity for the maintenance officer to help in eliminating such delays.

In track and bridge repairs and renewals, slow orders can often be eliminated or kept to a minimum length of time by careful planning before the work is started, and by close supervision and cooperation between the maintenance and operating forces during the progress of the work. Vigilance on the part of foremen and maintenance officers is necessary

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to detect slight irregularities in line and surface, especially in curves and spirals, and to correct them before they become serious enough to require the placing of a speed restriction. In cases where such defects develop to the point where they must be protected by a slow order, care should be taken to allow the highest safe speed, and every effort should be made to correct the condition as soon as possible.

One frequent cause for slow orders is the resulting effect of frost leaving the ground in the spring. This is particularly true on secondary or feeder lines, which are more subject to heaving in winter, and where ballast and drainage, as a rule, are not maintained to the same standard as on the more important districts. Where trains are operated over these feeder lines with important connections with main-line trains, slow orders present a severe handicap.

If track is put to good line and surface just before hard freezing weather sets in, it will come out of the winter and through the spring break-up in much better shape than if it enters the winter with irregularities in line and level. After the ballast has frozen and some heaving has taken place, such irregularities cannot well be corrected and will be accentuated by each passing train.

When Surfacing

In general, out-of-face surfacing, including tie renewals and reballasting, must be done under the protection of slow orders or caution signals, but while this is the general practice, it does not follow that such restrictions are invariably necessary. Under favorable conditions, where the raise is 2 in. or less, and tie renewals do not exceed two or three to the rail; where tangents are long and trains can be seen a considerable distance; where ballast is sufficient and kept filled in close behind the surfacing; it is possible to do such work without slow orders or other restrictions. However, as a rule, such ideal conditions do not exist, and whether or not slow orders are needed should be decided only after careful consideration of the factors involved by the responsible maintenance officer.

Old ballast should not be entirely stripped from track unless the new material to replace it is available. Track should not be left open overnight, if possible to avoid it. The open track requires a slow order and is subject to buckling. In many instances slow orders have been required on a stretch of track for a prolonged period because the stripping was done in anticipation, but without assurance, that the new ballast would be immediately available.

Bridge Work

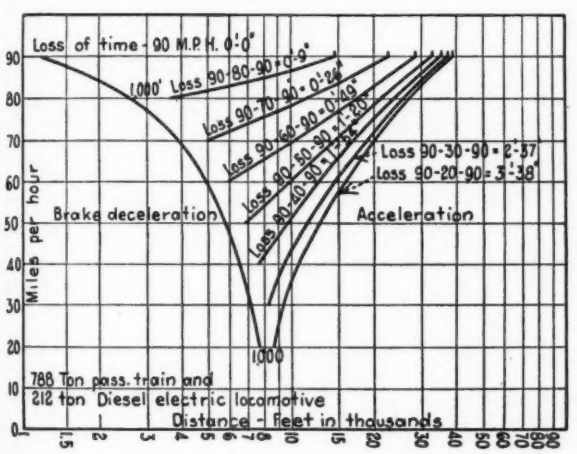
Many bridge and culvert jobs which are ordinarily done under slow-order protection can be carried out safely without it if the work is planned with that purpose in mind. In erecting new bridge spans of reinforced concrete or steel girders, many roads build them on falsework alongside the final location, from which place they are moved into position on rollers. The deck and rails can be placed beforehand, and in this way the old spans often can be taken out and the new ones placed with little, if any, interference to traffic.

Where there are curves immediately ahead of or adjoining a bridge to be renewed, it may be desirable to build the new structure on a new alinement altogether, leaving and returning to the old line at the approach curves. When new culverts are to be placed under an existing embankment, it is now common practice to jack corrugated metal or tongue-and-groove concrete pipe through the fill, rather than to place the pipe in an open trench as was done a few years ago. Trenching generally requires falsework to carry the track during the period of excavation and placing of the pipe, and no matter how well the trench is back-filled, there is likely to be a soft spot over the pipe for a long time. The jacking method can be used without interference with traffic and without leaving a soft spot which might be the cause of frequent slow orders.

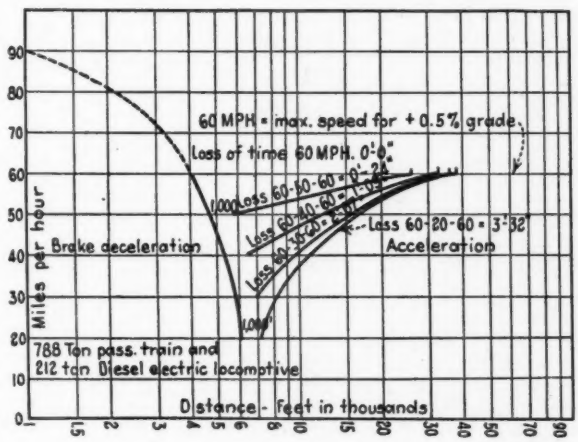
When main-line rail is to be renewed, it is often advisable to make all the renewals and to surface the track involved before the new rail is laid. At the close of each day, when laying new rail, all swinging ties should be picked up and the track left in good line. With a good tie condition and with the track surfaced just ahead of the laying of the new rail, very little smoothing and lining are necessary to allow normal speed without danger of damaging the new rail. On the other hand, if the tie condition and surface are poor, it will be necessary to keep a slow order of 25 to 40 m.p.h. on the track until it has been fully surfaced.

When careful study of a project indicates that it cannot be done while allowing the passage of all trains at normal speeds, consideration should be given to programming it, if possible, so as to affect a minimum number of trains. On many roads, some of the more important freight and passenger trains do not run on daily schedules. In such cases it may be possible to so plan the work that it can be done on the days these trains do not run, or at such hours of the day as to affect only less important trains. Frequently, if the foreman on the job is equipped with a portable telephone, he can, by keeping in touch with the dispatcher, have the track in safe condition for movement of the preferred trains without delay.

When new rail is being laid, or when other operations are being performed on heavy-traffic, single or multiple-track districts, circumstances may justify operating officers in assigning a trainmaster or assistant trainmaster to the job, who will stay with the work. Where this is done, the trainmaster or assistant trainmaster, by keeping in touch with the foreman and the dispatcher, can see that important trains are not delayed unnecessarily, and, at the same time, that the work is not interfered with more than absolutely necessary.


Loss of time - 90 M.P.H. 0'-0"
1,000' Loss 90-80-90 = 0'-9"
Loss 90-70-90 = 0'-24"
Loss 90-60-90 = 0'-49"
Loss 90-50-90 = 1'-20"
Loss 90-40-90 = 1'-58"
Loss 90-30-90 = 2'-37"
Loss 90-20-90 = 3'-38"
Brake deceleration
Acceleration
Miles per hour
788 Ton pass. train and
212 ton Diesel electric locomotive
Distance - Feet in thousands

Left — Showing Loss of Time When Speed Is Reduced from 90 M.P.H.


60 MPH = max. speed for + 0.5% grade.
Loss of time 60 MPH. 0'-0"
1,000' Loss 60-50-60 = 0'-28"
Loss 60-40-60 = 1'-08"
Loss 60-30-60 = 2'-01"
Loss 60-20-60 = 3'-32"
Brake deceleration
Acceleration
Miles per hour
788 Ton pass. train and
212 ton Diesel electric locomotive
Distance - Feet in thousands

Right — Chart Showing Loss of Time When Speed of a Particular Train Is Reduced from 60 M.P.H.

Jobs that require restrictions should be planned so there will not be a number of them at scattered locations on a district at the same time. Sufficient force, equipped with time and labor-saving devices, such as air compressors, air and electric tampers, power wrenches, drills, saws, etc., as may be appropriate, should be assigned to each project so that it can be carried through to completion in the shortest time consistent with good workmanship. It should be known before starting that all material required is on hand, or will be available as needed, to prevent delays which will lengthen the time that speeds must be restricted. In some cases, the use of off-track machines, rather than those running on the rails, will help make restrictions unnecessary.

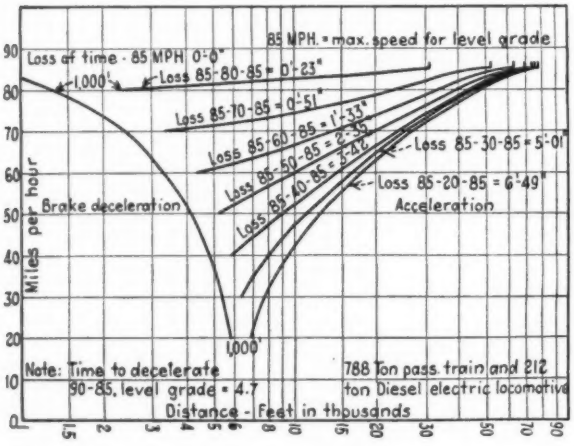
When a project is of a nature which will require a very low speed restriction for a considerable period, the circumstances may justify a temporary realinement of the main track around the work, over which trains can be operated at only slightly reduced speed. In some cases, such detours have been on alinements which have permitted speeds as high as 60 m.p.h.

Operations on "Dead" Track

In multiple-track territory where one track can be "killed" during working hours, it has been possible in some cases to work out a carefully prepared program which permits handling all the necessary out-of-face work on "dead" track, including the unloading and laying of the new rail, the picking up of the old rail and fastenings, removing the old ballast, making tie renewals, and ballasting and surfacing, leaving only the spotting and finishing to be performed under traffic.

Several roads have carried out such a plan to greater or lesser degree. On one road the plan has called for the installation of temporary high-speed crossovers, with phone operators and switch tenders, at each end of a section of track approximately 10 miles long. Where feasible to do so, the temporary crossovers have been located between stations or at other favorable locations, to permit one or two intermediate offices or control stations between the crossovers to facilitate train handling under manual block rules.

In some instances, ten gangs, aggregating 500 men or more, have been worked within these limits, each gang performing a maximum undisturbed day's work. Work trains are tied up in the direction that will avoid as much as possible their running through the gangs, and to keep them from making any moves on the "live" track. Gangs are impressed with the necessity of avoiding any movements on the live track, and of keeping regular trains moving without interruption. Trains are not flagged or slowed on the "live" track, except in cases of emergency.


85 MPH. = max. speed for level grade
Loss at time - 85 MPH 0'-0"
1,000'
Loss 85-80-85 = 0'-23"
Loss 85-70-85 = 0'-51"
Loss 85-60-85 = 1'-33"
Loss 85-50-85 = 2'-35"
Loss 85-40-85 = 3'-46"
Loss 85-30-85 = 5'-01"
Loss 85-20-85 = 6'-49"
Brake deceleration
Acceleration
Miles per hour
1,000'
Note: Time to decelerate 90-85, level grade = 4.7
788 Ton pass. train and 212 ton Diesel electric locomotive
Distance - Feet in thousands

What Happens When Speed of Train Is Reduced from 85 M.P.H.

After carefully programming each item of the work, the plan is laid out in blueprint form, outlining the scope of the project and giving all the necessary data to carry out the plan in detail.

Fleeting Trains

On heavy-traffic, single-track lines, particularly in certain centralized-traffic-control territories, it is frequently necessary to institute a practice of "fleeting" trains past heavy rail laying work, moving them in groups, holding back less important trains, and accepting a certain amount of train delays, if sufficient time is to be allowed the gang to do the work effectively and economically.

When planning work which will require that restrictions be placed on important trains, and throughout the progress of such work, close co-operation should be maintained between the maintenance department and the dispatchers and other operating department officers affected.

When issued, slow orders should define clearly the limits of the slow track and should allow the maximum speed that the conditions covered will permit. Orders should not be issued calling for excessively low speeds on the assumption that enginemen will operate at whatever speeds they consider safe. Such a practice can easily result in excessive delays to trains and a lack of respect on the part of enginemen for such restrictions as are issued. Orders should state the proper speed, and then should be rigidly enforced. Where the limits of slow track can be shortened as work progresses, the orders should be promptly changed accordingly.

Hand Discs

When caution signals are used to protect surfacing and similar track work during working hours only, and no orders are issued, as is customary on many roads, the foreman in charge should personally see that the signals are well painted so as to be readily seen by enginemen, and that they are placed in accordance with the rules, so the view will not be obscured by weeds or rendered indistinct by poor background. Generally, when such caution signals are used in the absence of an order, they indicate to the engineman that the track is good for one specific speed (10 m.p.h. on some roads; 15 m.p.h. on others), unless the foreman at the point where slow track begins displays a colored disc with figures indicating a higher speed (generally about 10 miles greater than allowable without the display of the disc). When such discs are used, foremen should have the track in shape for the higher speed for all important trains. If, when a train approaches, the track, in the judgment of the foreman, will permit safe passage at the speed indicated by the numbers on the disc, the foreman should immediately display it, standing in a spot where he can be plainly seen by the engineman. If important trains are due during the lunch hour of the gang, the track, if possible, should be put in condition for full normal speed, and caution signals should be removed until the gang resumes work. If this is not practicable, but the track will allow speed as indicated by the disc, the disc should be displayed.

Slow orders are sometimes allowed to run longer than necessary because of failure of the foreman or supervisor to keep in close touch with the orders affecting their track, and to remove them as soon as is possible to do so. Supervisors and foremen should make frequent inquiry of dispatchers, enginemen and trainmen as to slow orders. If this is done, they will avoid the possibility of some slow orders remaining in effect longer than is necessary.

Conclusion

All maintenance of way department employees, especially foremen and supervisors, should be impressed with the necessity of holding slow orders to a minimum. They should be educated along these lines and made to understand their responsibility in maintaining fast transportation service.

Work should be carefully planned with

the view to carrying it out with the minimum interference with traffic. Close co-operation between the maintenance of way and operating departments is essential, both in planning and carrying out work. Much can be done toward minimizing the need for slow orders by carrying out comprehensive plans for roadbed stabilization and subgrade drainage, curve reductions, bridge renewals, etc.

The increased production of heavy rail should make possible the replacement of badly worn lighter sections which, for lack of new rail allotments during the war, could not be changed out when they should have been. In many cases, the replacement of old rail with new rail of heavier section will permit higher speeds and, at the same time, reduce the amount of labor required to maintain the track in condition for the higher speeds.

Close supervision and prompt detection and correction of irregularities in surface, curve and line will promote better riding conditions and often prevent emergency slow orders.

Good judgment should be used in placing restrictions, allowing such speeds as are safe, and the importance of removing such restrictions as soon as possible cannot be over-emphasized.

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ROADMASTERS

Can Maintenance of Way Costs Be Reduced?

By F. R. Layng
Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

EACH one of us is definitely conscious of the high cost of living, and we are particularly impressed with the startling increase in recent months. Much of this is due to wage increases. Each of us in our personal affairs has undoubtedly made adjustments in our expenditures to meet this situation.

It should not be forgotten that the railroad companies by which we are employed have also been faced with a substantial increase in the cost of living. This is due not only to an increase in the cost of materials, but is also the result of higher wages now being paid and changes in working agreements and taxes that add to wage costs; for example, vacations with pay and increased payments in connection with the Railroad Retirement Act and Unemployment Insurance. The increasing cost of labor used in the maintenance of way department emphasizes the necessity of bringing about a substantial reduction in costs. At the present time probably 60 per cent, and in some cases as high as 70 per cent, of the costs of maintenance of way and structures are dirctly chargeable to labor, and I suspect that future changes in our agreements covering working conditions will tend further to increase these expenditures.

Dollar Value Shrinks

For many years, our figures show, the labor cost of applying a dollar's worth of material was about a dollar. This relationship reminded fairly constant until about 1941. Since that time it has increased, so that in 1945 it cost $2.50 to apply a dollar's worth of material. In 1941 the average hourly rate in our track department was 54 cents. In 1945 it was 82 cents, and for the seven months of 1946, 87 cents, showing an increase of approximately 60 per cent. Assuming that only 75 per cent of the total time on duty is used in productive work due to travel time, delays by trains, etc., the actual cost per hour for productive work would be $1.16 and, in many cases, due to density of traffic, etc., it will be much higher. Taking our labor costs as a whole, for all departments, we find approximately the same percentage of increase.

I think it is a fair assumption that we cannot look forward to a reduction in labor rates, so it becomes absolutely necessary to devise other ways and means to reduce expenditures. They can be reduced in two ways. One is to cut forces and suspend, as far as possible, the application of new materials. If this method is adopted it immediately brings us face to face with a program of under-maintenance and introduces so many undesirable elements that it should be the last method to be considered. The other course is to adopt methods that will encourage greater production, extend the service life of all materials used, and then, by intensive planning, develop better methods of carrying on the numerous operations that are necessary to maintain our properties.

Must Reduce Costs

It is my observation that since the wage increases were granted there is a definite spirit of defeat in the minds of many railway maintenance officers, and I suspect that many of them feel there is nothing to do but "cut to the bone." Maintenance of way costs must be reduced and it is my conviction that they can be cut substantially if the second method suggested is conscientiously and vigorously followed. It is my purpose to outline to you some methods that will assist in accomplishing this end.

One of the first things to be done is to convince ourselves that there are ways and means available to make substantial reductions in maintenance costs and then to convince those in direct charge of the work that this can be done. In the following I will outline briefly certain steps that I believe can be taken to reduce labor costs substantially, discussing them under the headings of Supervision, Maintenance of Way Machines, Extending the Service Life of Materials, Retiring Unused Facilities, and last, and most important Reducing Labor Costs in Track Maintenance.

Supervision

It is recognized that supervision of maintenance of way operations presents many difficulties due to the nature of the work and to the further fact that the gangs performing work are scattered over considerable territory. It is impossible for a supervisory officer to be present at all times where work is performed. These facts, however, simply emphasize the need for more intensive supervision. It is my observation that most maintenance of way officers in direct charge of work should be given more assistance and should be relieved of many of the duties now assigned to them that do not bear directly on the handling of the labor and materials directly under their jurisdiction. We cannot expect to reduce costs, particularly labor costs, unless adequate supervision is provided. When I say proper supervision I mean not merely occasional visits to the work, but real intensive planning, inspection and leadership. Planning will eliminate most delays and will

save time lost in making unnecessary moves. Co-ordinating the various stages of the work so that each will follow in its proper sequence is essential. Inspection, either to determine the necessity for doing a job or how to do it, is too frequently left undone.

A primary requirement in doing work economically is to avoid the interruption of work during its progress to take up some other job that seems to demand attention. As far as possible, once a job is undertaken it should be carried to conclusion before taking up other work.

A frequent source of low production is excessive travel time, and this should be given careful attention by the supervisory officer to see that it is held to a minimum.

Section of Heavy-Duty Track on the B. & L. E.

The same may also be said of overtime, which should be held only to what is absolutely necessary. Substantial cost reductions can be made if unnecessary travel time and unnecessary overtime are brought under proper control.

A careful study should be made of all work-train service. The very nature of this service implies that delays will be encountered, so that the amount of productive work actually performed is frequently excessively low. Every means to avoid using a work train in maintenance of way operations should be explored.

Machines

In recent years a considerable number of machines have been developed to carry out maintenance of way work, and manufacturers of maintenance equipment are continually working on new and better machines to perform various operations. One important operation in track maintenance—rail laying—illustrates the results very well. Actual figures kept on a recent highly-mechanized job where 152-lb. rail was laid, replacing 130-lb. steel, showed that the output per man was doubled over what it had been previously without the use of machines. On this job the power equipment used included wrenches, spike pullers, adzers, a rail-laying unit and spike drivers. The quality of the work was far superior to what could have been done by hand methods. An illustration of this aspect is afforded by the tie adzer. No adzing done by hand can compare with the quality of the work done by the adzing machine, and this is also true of the work done with many other power tools developed in recent years.

The use of off-track machines is to be encouraged as a definite step in the right direction. Experience shows clearly that the introduction of machines in maintenance of way work will frequently cut labor costs in the neighborhood of 50 per cent. Careful study should be given to assigning the proper machines for the job at hand. It goes without saying that these machines should be maintained in first-class condition to avoid delays due to breakdowns that will retard the progress of the work. On the whole, it is clear that sufficient attention has not been given to the full use of machines now available.

Extending Service Life

One of the most productive methods of reducing labor costs is to extend the service life of materials. It is not my purpose to try to outline the different methods of accomplishing this, but I wish to emphasize the importance of adopting every method that promises to extend service life. This is well illustrated by the use of treated ties and the preservative treatment of other wood products. With the use of untreated ties the service life is, on the average, about eight years, and by the use of treated ties properly protected against mechanical wear, the service life should be in the neighborhood of 30 years.

The saving in labor involved in connection with the renewal of ties is probably as important as the saving that is realized in material costs. The same statement is true in regard to rail conservation. The use of rail lubricators, the building up of battered rail ends by welding, the spraying of track materials to prevent corrosion, the end hardening of rail, are all methods of extending the service life of materials that have demonstrated their value and, as a whole, have not been as generally adopted as they should be.

Extending the service life of rail has an important bearing when considering the use of the heavier rail sections. Before the methods outlined above were developed, the service life of rail was determined by end batter and curve wear, particularly end batter. A startling small percentage of the total rail tonnage involved determined the time for the replacement of the whole. Now, by using these well-known methods of extending service life it is possible to double or even triple the time rail remains in the track. Because of this, the economies involved in the use of the heavier rail sections have entirely changed. In such a study it should not be forgotten that when rail is taken out of the track, the salvage value of that removed is approximately half its first cost. Incidentally, it may be emphasized that the cost of rail has remained in the area of about $40 per ton for many years. The price is now $47. I know of no material used by the railroads that can show a like stability as to price.

Retire Unused Facilities

A few railroads have made substantial progress in retiring unused facilities. This is a most attractive way to reduce maintenance costs. A facility that is not used, whether it is a track, a building, or any other part of the fixed property, usually has some salvage value. If it is not retired the salvage is not recovered and the facility gradually deteriorates until the salvage value may disappear. It is also true that as long as a facility is allowed to remain, some expenditures will be made towards its inspection and maintenance. The principle is definitely established that if a facility is not necessary it should be promptly retired. A number of roads have made substantial savings by doing this—but much remains to be done on many roads.

Costs

An analysis of the labor expended on track laying and surfacing on our railroad shows the following relationship between the various operations included in this account:

	Per cent of total
Applying ballast	15
Applying ties	15
Applying rail	10
Applying other track material	5
Track maintenance (lining, surfacing, gaging, tightening bolts, etc.)	55

As the item of track maintenance constitutes more than half of the account, this item should be analyzed carefully with the idea of making any possible reduction. This work consists principally of restoring line, surface and gage, and it is well known that

the stiffer the track structure, the less labor will be required to hold it to a desired standard. This has become more evident in the last 10 years, during which time there has been a marked increase in speed, volume of traffic, and weight of both passenger and freight equipment.

Rail Most Important

In the construction of stiffer track, the item of rail is most important. In his book on the Economic Theory of Railway Location, A. M. Wellington very forcibly emphasizes the importance of stiffness in rail. He is quoted as follows: "In buying rails we are not buying steel; at least we do not care to buy it. We are buying three imponderable qualities, (1) stiffness, (2) strength, (3) durability. If we get our money's worth of these qualities it is a matter of complete indifference (except the future scrap value of the steel) whether we get much or little steel. If we do not get our money's worth of what we want, our bargain is just as bad, however much steel we get." He then asks the question, "How much stiffness do we get for a dollar with light or heavy rails?"

Table I compares the stiffness of the sections now commonly in use, and reduces this quality to what it costs per ton in the several sections listed on the basis that a ton of steel rail costs $47. From this table it will be seen that if stiffness is such an important item it can be secured at a much cheaper rate in the heavier sections. As the table shows, in the 90-lb. section the stiffness purchased costs $47 per ton, while in the 152-lb, section the stiffness purchased costs $14.20 per ton.

Table I—Cost Per Ton of Stiffness in Various Rail Sections

Rail section	Moment of inertia	Stiffness compared with 90-lb. RA (per cent)	Price per ton stiffness
90-lb. RA	38.70	100.0	$47.00
100-lb. A (ASCE)	43.97	113.6	41.50
100-lb. B (ARA)	41.30	106.7	44.10
112-lb. RE	65.5	169.2	27.80
130-lb. PS	72.8	188.1	25.00
131-lb. RE	88.5	228.6	20.60
152-lb. PS	128.0	330.8	14.20

Labor Reduction

Owing to the increase in stiffness as the weight of rail increases, there is a marked reduction in the amount of labor required to maintain track with the heavier rail sections. Lack of stiffness accentuates the wave motion of rail, thus causing increased vertical movement of the ties. These repeated blows of the ties wear out the ballast and tend to drive fine material up from the subgrade through the ballast and foul it. Then, with increased moisture conditions, churning results. Since the greater stiffness of heavier rail reduces the amplitude of wave motion, and therefore the vertical movement of the ties, churning is minimized and the amount of labor involved in surfacing track is reduced.

In 1917 we started to replace 100-lb. rail in our main tracks with the 130-lb. section. That year we used 1,257,000 man-hours chargeable to Account 220, Track Laying and Surfacing. In 1934 we adopted the 131-lb. section, and in 1939 we adopted the 152-lb. section. In 1939 we used 493,800 man-hours chargeable to Account 220.

By the end of 1945 we had relaid about 25 per cent of our main tracks with the 152-lb. section. In that year we used 448,400 man-hours chargeable to Account 220. During this period (1917 to 1945) our standards for track maintenance have been steadily raised; and tonnage, wheel loads and speed have all increased. Using a basis of 100 for the man-hours charged to Account 220 in 1917, we used 39.3 per cent in 1939 and 35.7 per cent in 1945. We attribute this drop to putting into practice many of the suggestions I have outlined above, but it is our belief that the principal reason for the reduction has been our use of the heavier rail sections.

The heavier rail section not only beneficially affects track laying and surfacing but also practically every element making up the track structure, and contributes materially to the reduction in labor required to maintain each of the items involved. Some of these savings are mentioned briefly as follows:

Other Savings

The larger rail section provides deeper angle bars, and therefore stronger joints. In this connection, it may again be emphasized that end hardening, the building up of battered rail ends, the use of rail lubricators, etc., have contributed very substantially to the longer life of rail. Under normal main-line conditions, the average life of 100-lb. rail on our road was 6½ years. The average life of 130-lb. rail was 13 years. These figures relate to the period before we adopted end hardening, the building up of rail ends, and the use of rail lubricators, but they do show very definitely the increased service life secured in passing from the 100-lb. section to the 130-lb. section. Our experience with the 152-lb. section is too limited to permit giving definite figures as to average service life, but we believe that there will be a substantial increase compared with the 130 or 131-lb. section.

ROADMASTERS

Ties Last Longer

Increasing the weight of rail also increases the service life of ties. By reason of greater girder strength, the larger rail distributes the load over a greater number of ties, thus reducing the stresses in the individual ties. The larger tie plate used when heavier rail sections are adopted also contributes to decreasing the unit pressure on the individual ties by spreading the load over a larger area. Ties also fail in large numbers as a result of mechanical wear caused by movement between the tie plate and the tie. Wear is greatly increased by the wave motion in the rail. Since the heavy rail is stiffer, wave motion is reduced, thus prolonging the life of those ties that would fail from plate cutting. Independent fastening of the tie plates to the ties still further reduces mechanical wear. Our experience in using screw spikes to attach the tie plates to the ties has been very satisfactory.

The following tabulation gives the number of tons of metal per mile of track for four of the rail sections now generally used (disregarding frogs and switches):

90-lb. RA—189.2 gross tons
112-lb. RE—240.7 " "
131-lb. RE—291.9 " "
152-lb. PS—326.6 " "

In the change from one section to the other, the additional metal per mile of track and the cost at $47 per ton f.o.b. mills are as shown in Table II.

Table II—Additional Metal and Cost Per Mile of Track for Different Rail Sections

Tonnage	Cost f.o.b. mills
90-lb. RA to 112-lb. RE—51.5 gross tons	$2,420.50
112-lb. RE to 131-lb. RE—51.2 " "	2,406.40
131-lb. RE to 152-lb. PS—34.5 " "	1,621.50

Additional Cost Returned

We figure that in changing from the 130 or 131-lb. section to the 152-lb. section we will pay for the additional cost of the change by savings in labor chargeable to Account 220 alone in from three to four years. In addition to this, we will realize the other savings mentioned above, as well as considerably less wear and tear on equipment. In other words, one of the greatest labor-saving devices we can use is one of the heavier rail sections. It is my belief that there are many railroads that have certain territories in which they could realize the same reduction in track maintenance cost as we have if they would adopt the heavier rail sections. Which section to be adopted will, of course, be governed by the conditions (traffic, speed, wheel loads, etc.) in the territory under consideration.

Inspection of Rail by Track Forces

Report of Committee

THE demand for steel for various purposes since the beginning of World War II has prevented delivery to the railroads of rail in sufficient quantities to compensate for the wear and breakage caused by the unprecedented volume of traffic handled. As a result, most railroads entered the post-war period with heavy deferred rail renewals, which will, of necessity, require several years to overcome. These conditions, together with the heavier power in general use, increased axle loads, and the demand for higher speeds to meet present-day competition, make the subject assigned to your committee of intense interest and concern to maintenance of way men.

The new rail now available to the railroads is of good design and receives every attention in its manufacture, including careful inspection from the mill furnace to the finished product. Many railroads maintain their own inspection service at the mills; others employ engineering firms that are equipped to render this service for them—all designed to produce rail with a longer service life and fewer failures.

As more new rail becomes available, it should be carefully allocated and applied where the need is most urgent, with the view to relieving the track forces of the most troublesome spots first. The new rail should be protected in every way possible against damage that leads to early failure. This can be accomplished best by the unloading and laying gangs, and proper maintenance after its installation.

A rail dropped from a car, or a careless blow by a spike maul, will materially reduce the life of the rail and lead to an early failure. Then, only by constant alertness on the part of the track forces can an accident be prevented.

Detector Cars

The operation of detector cars is of inestimable value in rail inspection, the frequency of the trips of such cars depending upon the density and class of traffic, the condition of the rail, and the past record of failures. If the car is operated at intervals of six months on the average well-maintained main line, it should keep the line relatively free of serious failures and pick up many defects that lead to failures. However, if a bad rail condition exists, it may be desirable to operate the car at more frequent intervals, the volume of failures found being the governing factor.

The operation of detector cars over a territory should in no way relieve the track forces from making a constant and thorough visual inspection of the rail, as there are some types of failures the cars do not discover and some failures they do not identify correctly because of influences outside of the rail itself.

Various articles have been written about the inspection of rail by the track forces, and many and varied practices are in effect, with the result that there is very little new that this committee can report; nevertheless, a discussion of some types of rail failures and some of the practices that lead to a safe and satisfactory inspection of the rail in track, is quite timely.

J. A. Stonebraker
Chairman

Common Failures

A few of the most common types of rail failures are as follows:

(1) Transverse fissure
(2) Compound fracture
(3) Engine-burn fracture
(4) Horizontal split head
(5) Vertical split head
(6) Piped rail
(7) Split web
(8) Broken base
(9) Rails damaged by broken wheels or in derailments
(10) Head-and-web separation

Other types of failures, perhaps, should be mentioned, but a discussion of those listed will suffice to stimulate interest and should cause additional ways to be devised to bring about better inspection and an improvement in conditions that lead to many failures. No doubt, every member of this association has witnessed large quantities of rail in the scrap pile due to one or more of these classes of failures.

A transverse fissure develops without warning or previous exterior indications, and while hair-line cracks do show in some instances when the fissure reaches the surface, this condition develops only shortly before final failure. Such failures are seldom found by visual inspection.

A compound fissure, which originates in a horizontal head split, and turns up or down in the head of the rail, has a smooth bright or dark surface, which progresses until it is at about right angles to the rail. This type failure is seldom found by visual inspection, and, if found, is usually in the later danger stage.

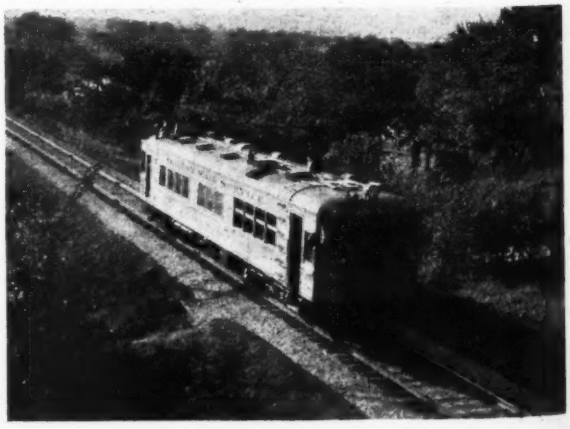
Engine-burn fractures are usually found around water cranes, stations, crossings, signals, etc., and are caused by the driving wheels of locomotives slipping on the rail. If the rail is badly burned, a fracture is sometimes caused below the burned spot, which will progress downward until rupture occurs, unless the rail is removed from the track.

This type of failure is not easily detected by visual inspection, except in the late or danger stages, and should receive special inspection by section foremen at frequent intervals. A magnifying mirror is of much help in locating hairline cracks.

Horizontal split heads are generally accompanied by flat spots on the running surface of the rail, and may be discovered readily and identified by visual inspection.

A vertical split head is a vertical split through or near the middle of the head, extending into or through it. A crack or a rust streak may show under the head, close to the web. An inspection mirror saves considerable time over the hand-and-knee inspection method.

Piped rail is one with a vertical split, usually in the web of the rail, due to a mill defect. Ample warning is usually afforded for visual inspection before actual failure resulting from either a vertical split or a pipe. The indications of imminent failure are about the same. In either case, longitudinal black streaks appear on the



The Operation of Detector Cars Is of Inestimable Value in Rail Inspection

running surface of the rail. In later stages, the split in the head usually reaches to or near the head fillet, and shows a fine streak of rust when it reaches the surface, being accompanied by a slight widening of the rail head. Such failures can be found by a walking inspection or from a slow-moving motor car. Rails showing these defects should be removed at once, as they may fail under a train.

Split Webs

Split webs occur most often near the ends of the rail, and are often referred to as bolt-hole breaks. This type of defect may be caused by an imperfection in the steel or by improperly located bolt holes, but more often it is the result of damage by spike-maul blows. If the split web appears in the center of a rail, it can be identified by a small rust streak.

The use of a mirror is of much advantage in locating this type of failure, unless it occurs within the confines of the angle bars, where it cannot be detected, until the fracture has progressed up through the web of the rail and has penetrated through the ball of the rail.

In territories where a large number of these failures occur, it is of great advantage to make a hammer test of the rail ends, to pick up the failures before they reach the ball of the rail and the danger stage. This is done by using a small hammer, and striking the rail a light blow on the top, or running surface, a few inches from the end of the rail. If a break has progressed in the web of the rail, it will be readily detected by the sound, which is much different than in the case of a perfect rail. If there is a considerable difference in the sound, the angle bars should be removed and the rail examined. Foremen and inspectors soon become proficient in making this test, thus making it possible to remove defective rails before actual breaks can have a chance to occur.

Broken Bases—Nicks

A broken base, sometimes called a half-moon break, usually results from seamy steel. The seams are sometimes evident, but more often obscure, and are usually located close to the center of the base. The crack sometimes follows along this seam line for several feet, but more often only a few inches, until the crack works out to the flange of the rail, forming the half moon. This type break usually occurs over a tie, and can be detected by a walking inspection. Rails containing such failures should be removed from the track promptly as they soon result in complete failures.

Nicks in the head of the rail caused by a broken wheel are generally not as serious as damage to the base, and most of them will wear off without causing permanent damage. Slow orders should be maintained over such damaged spots for a few days until all nicks are thoroughly examined. However, if the broken wheel becomes derailed and nicks occur in the base of the rail, the rail should be removed immediately. Good judgment is required on the part of the inspector or foreman in selecting the rails with nicked heads that should be removed. In case of derailments where no broken wheels are involved, but where the wheels follow along the base, striking spike heads and rail anchors, close inspection at frequent intervals should be made over a considerable period, as the damage caused may not become apparent for some time but later result in complete failure.

Separation

Head-and-web separation are usually found in road and street crossings, and in territories of heavy grades and sharp curvature, more often appearing on the low rail of sharp curves. This type of failure is the cause of some concern to maintenance of way men.

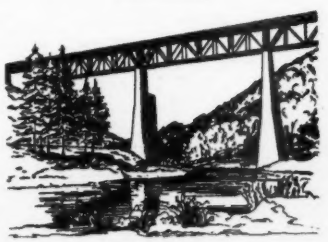
In the case of these failures, the ball of the rail wears down and rolls out on each side of the head, causing the head to become flat and of abnormal width. Where this occurs, the various wheel contours cause a reversal of the stresses in the web, eventually causing head and web separation. These defects are usually not recorded by detector cars unless they have developed into a dangerous condition. However, they can always be found by a close visual inspection before they become dangerous. An inspection mirror is of material benefit over the hand-and-knee method in speeding up this inspection.

Frequent hammer tests at regular intervals should be made of rails in crossings to detect head-and-web separations, taking up the planks or other material so that a close inspection can be made. The frequency of these inspections should depend on the class of territory involved, the general condition of the rail, and the train speeds permitted. The stock rails of switches should also be inspected carefully and frequently for the head-and-web separation type of failure.

Conclusion

Since the operation of detector cars has come into general use, much progress has been made in the inspection of rail in track. However, the usual inspection of rail in track by the track forces is necessary, regardless of the operation of these cars. The nature and frequency of such visual inspections from rail to rail, and the methods to be employed, must, of necessity, be determined by the past performance of the rail as to failures, as well as by the curvature, grades, density of traffic, rail section in use, axle loadings, class of territory, and the general standard of track maintenance employed.

The track forces should be on the alert continuously to locate rail failures of every type, and should be able to identify correctly all types of failures found. They should also make every effort to correct maintenance practices and abuses that are likely to lead to rail failures.



ROADMASTERS

Committee Personnel

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Inspecting Rail with a Special Mirror

D. R. G. & W., Pueblo, Colo.; L. E. Smith, mstr. trns. & trk., Mo.-Ill., Bonne Terre, Mo.; F. H. Masters, ch. engr., E. J. & E., Joliet, Ill.; T. N. Turner, rdm., M. P., Newport, Ark.; H. D. VanVranken, ch. engr., Jacksonville Term., Jacksonville, Fla.; T. J. Vansandt, rdm., S. P., Roseville, Cal.; F. L. Vault, Jr., supvr. trk., N. Y. C., Remsen, N. Y.; J. G. West, div. engr., A. T. & S. F., Slaton, Tex.; C. E. Winkler, rdm., Ill. Term., Alton, Ill., and V. Hankins, div. rdm., G. N., Whitefish, Mont.

Discussion

In reply to a question from the floor, Chairman Stonebraker stated that, in making the hammer test mentioned in the report, a rail having a split web produces a dull sound when struck with a hammer, compared with the ringing sound produced by a sound rail.

W. M. S. Dunn (N.Y.C. & St. L.) observed that in many cases the presence of a vertical split head can be detected by close visual inspection. This view was also expressed by J. E. Griffith (Sou.), who stated that in many instances the defect is indicated by a dark streak on the top of the rail, which starting on the gage side, extends to the center of the ball and then returns to the gage corner.

R. H. Gilkey (C. of Ga.) pointed out that the report makes no reference to shelly rail, adding that many fractures had been known to develop at shelly spots. W. J. Cruse (G.N.) said that Sperry car tests of shelly rail on his road had resulted in the detection of a number of progressive fractures. Mr. Cruse also told of the early development of shelly spots in 112-lb. rail on the high sides of curves, which were attributed to the flow of metal caused by the flat contour of the rail head.

L. T. Nuckols (C. & O.) asked if the present rail sections are satisfactory, adding that in his opinion the head is much flatter than is desirable.

W. A. Sparks (C. & O.) expressed the opinion that if maintenance officers could adopt a standard rail section of their own design, it would differ considerably from the sections now in use. He challenged the mechanical department to give closer attention to the maintenance of car wheels, pointing out that many rail failures are caused by the uneven stresses set up by worn wheels. Mr. Sparks concluded his remarks with the advice that many rail failures can be eliminated if the track is carefully worked immediately before and after the rail has been renewed, and added the thought that the demands on the track structure, now and in the future, can be met only by adhering strictly to the highest standards of maintenance.

Maintenance Problems in C. T. C. Territory

Report of Committee

CENTRALIZED traffic control is a term applied to a system of railroad operation, by means of which the movements of trains over routes and through blocks on a designated section of track, or tracks, are authorized and directed by the indications of signals controlled from a central point, without the use of timetables, superiority of trains, or train orders. In short, in CTC operation, the dispatcher, by means of controlled signals and switches, is able to direct the movements of trains to meet conditions as they arise.

By means of track-occupancy indication lamps on the track diagram, which forms a part of the control machine, the man in charge is constantly provided with up-to-the-minute information concerning the progress being made by each train in the territory. With this information, the decision as to the locations at which trains are to meet or pass can be deferred until the trains are within a few miles of the points involved. The signal indications are, in effect, the train orders, each signal delivering its order as the train approaches it, and the engineman being governed at that place by the information he receives there.

Advantages

It is evident that, with CTC, the meets and passes between trains can be made safely, on every close time, thus eliminating much needless train delay incurred in the time-table and train-order system of operation. The flexibility of CTC operation results in considerable more use being made of sidings by passenger trains, and through the installation of lap sidings, the lengthening of passing tracks, and by skillful manipulation of the control machine, a considerable percentage of meets can be made without either train being stopped. This feature, in itself, is the cause of greater maintenance problems in CTC territory, for

G. L. Morrison
Chairman

not only does it result in more traffic through turnouts, but the speed through sidings is considerably faster than under normal operation.

Switches

To accommodate the increased speed through turnouts, frogs of flatter angle than normal are generally installed, usually a No. 14 or flatter angle frog being used.

The power machine at each switch is equipped with a lock rod on which the adjustment is 1/16 in., and if the switch should be out of adjustment, or the locking device not able to function, the signal system is immediately out, and, until fixed, operation reverts to unsignaled track operation, but with the disadvantage of no train-order offices to handle movements by that method.

The switches are, therefore, of primary importance in CTC track maintenance, and the slack that is acceptable in hand-throw switches cannot be tolerated. Gage, alinement, surface and fit of switch points must be maintained in near perfect condition. Proper fit of points against stock rails can be maintained by grinding the overflow of metal from the stock rails and points. This also materially retards chipping of metal from the points. This grinding should also be done to the wing rails of frogs to insure tight fit and prevent point batter.

Due to the increase in speed through turnouts, particular attention must be paid to switch braces, and care exercised to see that all wear is promptly taken up, and that the braces are maintained at all times to the proper fit. The same need applies to tie-rod bolts, which must be kept tight at all times to insure the proper fit of the switch points. Keeping switch-point slide plates clean and properly lubricated is another feature of switch maintenance that must be properly taken care of, as only a small amount of dirt or foreign material will result in failure of the signal system. A mixture of flake graphite and kerosene, or switchlight oil, has proven effective and overcomes the objections of using ordinary oil, which readily picks up dirt. The flake graphite lubricating medium is best applied with a paint brush.

Drainage at Switches

Proper alinement and surface at CTC switches calls for a good ballast section, which must be of sufficient depth to insure proper drainage, and the ballast shoulders must be kept clean at all times. This is of particular importance in snow and heavy-rain territories, where, due to the amount of moisture accumulating by reason of storms, signal failures might result if the ballast section does not afford ready drain-

age, and the roadbed is not properly ditched and sloped to take care of the runoff. Track must be kept tamped up through the switches, and the ties must be kept up tight against the rail, to preclude any vertical or lateral movement of the switch rails that will interfere with the motor and signal controls.

Switch ties should be uniform in size, kept properly spaced, and renewed when mechanical wear becomes evident. When plate-cut ties permit the rail to cant and change the gage, it is not possible to maintain proper fit between the switch points and stock rails.

Anchoring Switches

Anchoring the rail against running is a "must" job in CTC territory. Running of the rail will adversely affect the switch and signal control mechanism quicker than any other factor, and both main and side tracks must be properly and adequately anchored against running of the rail. Many factors enter into the problem of adequately anchoring switches, and each road must devise its own method. On one road the practice is to box all ties, except joint ties (four anti-creepers per tie) for 48 ties ahead of the points, and for 48 ties back of the frog, on both main tracks and siding. Through the turnout, between heel of switch points and toe of frog, the ties are boxed at each rail with anti-creepers (eight to each tie). Anti-Creepers are also applied to the outside rails between point and heel of switch points. This plan calls for using from 1,100 to 1,500 rail anti-creepers at each switch, depending on the length of the turnout, and has proven generally satisfactory.

Maintaining rail anti-creepers tight against the ties must be done, and, regardless of the method used in anchoring the rail, this must be watched and changes and adjustments made as conditions demand. On new CTC installations, this matter is of paramount importance, for if the anti-creepers are not kept seated against the ties, expansion allowance may become lost or bunched, with resultant jamming of the switch points.

In Snow Territory

In snow territory, keeping CTC switches open and operating also calls for added precautions, for a one-inch snowfall will cause motor-controlled switches to fail. The use of switch heaters in snow territories has proven successful, and their use is recommended. Thirteen heaters to each turnout, in general, are sufficient. Five heaters are used at each switch point, one heater for each guard rail, and one at the frog if spring-rail frogs are used. One attendant is necessary at each switch location to keep the heaters burning and adjusted, and to keep them supplied with fuel. A shelter shed with a heating stove should be provided for each attendant. In locations of severe blizzard conditions, it has been found necessary to augment the switch heaters by the use of several track men, and, where this is necessary, a larger shelter shed should be provided.

A supply of fuel oil for the heaters, sufficient to last beyond the storm's duration, must be provided near each switch. A successful installation consists of a 550-gal. tank buried in the ground adjacent to each switch. The tank is equipped with a hand pump, housed in a box which can be locked. These tanks are filled from a tank car with a hose connection, which is held on hand through the winter season and handled by work train or local when necessary to refill the tanks.

Propane Gas Heaters

Some roads use propane gas switch heaters, and early installations of this type of burner called for one long burner against the rail. Later installations, however, provide for separate unit burners placed in the tie cribs under the rail and switch points. Two types of such burners are available; one, a coil generator type, and the other an atomizing type. The coil burner does its own generating and requires only 5 to 6 lb. pressure on the fuel tank, while the atomizer type requires pressure on the fuel tanks to deliver fuel to the atomizer, and also an air line to deliver the required air to the fuel to produce the heat flame at the burner.

Propane gas heater installations require a regulator between the gas cylinder and the feed line of the heaters as the cylinder has a natural pressure of 100 lb. and considerably lower pressure is required at the burner. High pressure will deliver the fuel to the burner too fast. This type of heater requires minimum maintenance, the main problem being to keep the orifice of each burner clean.

Section foremen's houses should be equipped with telephones connected with the dispatcher so the gangs can be called when storms start.

Showing Provision for Drainage Adjacent to Switch in C.T.C. Territory

Providing Drainage

To take care of drainage properly around switches in snow territory, an adequate system of drainage must be provided. If switches are located in cuts, the cuts should be wide enough so that adequate side drainage ditches can be installed to carry off the water resulting from the use of heaters at switches. On embankments the roadbed must be kept free of any obstacle that would hinder the flow of water away from the track structure.

Emergency supplies of switch points, frogs and other essential track material should be carried on hand at central points for use in replacements in case switches are torn up by derailments or other types of accidents.

Section foremen and signal maintainers must realize that switches in CTC territory are not subject to inspection on the part of train crews, as are hand-thrown switches, and, therefore, that they must make frequent inspections of these switches, making minor repairs immediately when the need for such repairs is noted on these inspections.

Sidings

Much of this report has dealt with switches, which are of principal concern, but passing sidings also call for special attention due to the flexibility of operation in CTC territory wherein these sidings are subject to more extensive and faster traffic, including passenger trains. Many sidings have been increased in length to permit the meeting of trains without stopping. The allowable speed through such sidings should conform to the speed permitted through the turnouts.

From this it follows that passing sidings must be built and maintained to a higher standard than is necessary in conventional operation. They should be laid with heavy rail, fully tied and plated, and ballasted with a good quality of ballast. The maintenance standard should equal that of main

ROADMASTERS

track, with proper line and gage at all times. Tie renewals must be made when a need for them is indicated.

Rail Renewals

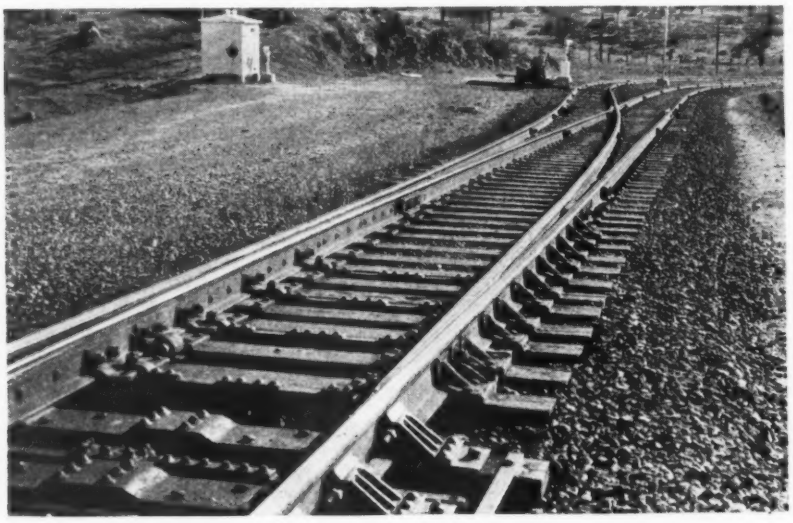
Renewing rail in CTC territory presents the possibility of greater train delays than in other territories. This is true because trains cannot proceed to the point where the rail renewals are under way and then proceed past the work on signal from the track foreman, but must lay back at the nearest station. To avoid delays, those in charge of rail renewals must keep in contact with the dispatcher and close up their work within the time allotted by the dispatcher. When giving permission to use a specified section of track for a definite period of time, the dispatcher should tag the controls of that section of track, thus indicating to him that track is out of his control. These tags should not be removed until he is advised by those in charge of the rail-renewal gangs that the track is clear and ready for traffic. Those in charge of track gangs must program their work so that the track will be ready for traffic within the specified time.

In carrying out rail renewals under the above conditions, it is essential that bolting, gaging and spiking follow closely behind the actual rail laying. Particular attention must be paid to the work to see that not too much track is opened up. In case unforeseen circumstances arise, making it impossible to close up the work within the allotted time, the dispatcher should be notified at once. A portable telephone should be used when work of this nature is under way.

In case it is necessary to change out a broken rail, the section foreman must contact the dispatcher and work in conjunction with him. All maintenance of way work should be done under flag protection, regardless of the fact that a section of track may be turned over to track forces for a definite period.

Motor car operation by the maintenance of way forces through CTC territory must be governed by signal indicators, since the signals in CTC territory are dark unless a line up is made for a train by the dispatcher, and since a line up may be made for a considerable time ahead of the actual arrival of the train. The maintenance forces using motor cars should be schooled in this operation to avoid delays to their work.

In some installations, signal indicators have been installed which indicate only the occupancy of sidings, these being found necessary owing to the speed with which trains leave sidings equipped with power-operated switches. These indicators should be marked "sidings only" and the maintenance of way forces should be properly educated in their use.



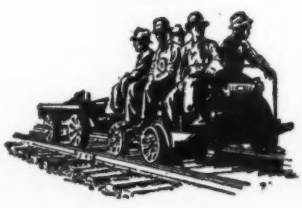
Showing Method of Anchoring Rail Through Switch in C.T.C. Territory

In connection with a recently completed CTC installation on one western road, the track motor cars to be operated in the territory involved were equipped with signal indicators, which are actuated by the track circuits and give the motor car operators indications of approaching trains. This is a new installation and sufficient information is not at hand to make any discussion possible.

Work Trains

The efficiency of work trains in CTC territory depends on close co-operation between the maintenance supervisor in charge of work trains and the dispatcher, for by the nature of the signal system in CTC territory, it is not possible for a regular train to approach the location where a work train is operating, and it can only be cleared by the work train going to the next siding in advance. It is the general practice for the work train conductor to obtain permission from the dispatcher to operate on a certain strip of track for a specified time, clearing the track at the time specified, unless additional time is obtained from the dispatcher. The use of portable telephones by work-train crews has proven advantageous, and this practice should be adopted wherever possible.

Inasmuch as the dispatcher has absolute control of the track in CTC territory, he can be of considerable assistance, providing proper contact is made, and there is no inclination to steal a few minutes beyond the time limit given for the use of the track.



"Call-On" Lights

Present installations call for a relay house adjacent to CTC switches, and these houses are usually provided with a telephone directly connected to the dispatcher's phone circuit. These relay houses usually have a "call-on" light, which can be turned on by the dispatcher. Where such a light is provided, it is the practice to instruct all maintenance forces to call the dispatcher whenever they see the "call-on" light illuminated. This materially reduces delays in case trouble occurs at any point. It has also been found helpful to instruct maintenance crews to keep the dispatcher advised of the approximate territory where they can be found in case of trouble.

Committee Personnel

G. L. Morrison (chairman), asst. engr. m. of w. & s., S. P., San Francisco, Cal.; J. L. Hopkins (vice-chairman), trk. supvr., A. T. & S. F., San Juan, Capistrano, Cal.; A. B. Chaney (vice-chairman), dist. engr., M. P., Little Rock, Ark.; W. H. Hillis, ch. oper. off., C. R. I. & P., Chicago; D. M. Clarke, sales engr., The P. & M. Co., New York; M. L. Denny, trk. supvr., I. U., Indianapolis, Ind.; G. J. Diver, vice-pres., Morrison Railway Supply Corp., Buffalo, N. Y.; M. L. Doyle, trk. supvr., B. & O., Deshler, Ohio; J. J. Gallagher, The P. & M. Co., Denver, Colo.; D. B. Neel, rdm., S. A. L., Tampa, Fla.; J. R. Graham, field engr., Nordberg Mfg. Co., Chicago; C. E. Neal, rdm., S. P., Dunsmuir, Cal.; P. H. Hamilton, Baltimore, Md.; R. W. Lucas, rdm., C. R. I. & P., La Salle, Ill.; J. J. Metzger, St. Louis, Mo.; G. B. McClellan, rdm., T. & P., Ft. Worth, Tex.; M. Corgiat, trk. supvr., C. R. I. & P., La Salle, Ill.; C. R. Schoenfielder, rdm., C. B. & Q., Aurora, Ill.; G. S. Turner, div. engr., D. & R. G. W., Pueblo, Colo.; P. L. Koehler, asst. supt., C. & O., Peach Creek, W. Va.

Discussion

E. L. Banion (A.T. & S.F.) opened the discussion by expressing concern regarding the safety of motor car operation on C.T.C. track, particularly where color-light signals are used, and asked for further information as to the practices on other roads. H. V. Meek (D. & R.G.W.) responded that motor cars on his road are equipped with portable telephones, and, in addition, that motor car movements are protected by the dispatcher who authorizes a specified length of time for movement from point to point.

W. H. Kellogg (P.M.) added that on his road the speed of motor cars over C.T.C. switches is restricted to 2 m.p.h.

H. S. Chandler (C. & O.) stated that line-ups are given to track-car operators on the C. & O., but that these men do not make a report when the cars have been placed in the clear. Also, he said, speeds are reduced through C.T.C. switches. The practices of another road in using signal indicators on motor cars in C.T.C. territory, and in requiring such cars to come to a stop before passing over C.T.C. switches, were cited.

T. M. Turner (M.P.) stated that he had experienced no particular difficulty with motor car operations on C.T.C. track but that he has had considerable trouble in keeping the switches clear of snow, ice and sleet. In reply to an inquiry regarding the economical size of a rail-laying gang for C.T.C. track, Mr. Turner replied that he had secured good results with a gang of 75 to 100 men, adding that on such track it is essential to work closely with the dispatcher, never attempting to exceed the working time allotted by him.

ROADMASTERS

Tie Failures and Measures to Overcome Them

Report of Committee

WITH crosstie and switch-tie stocks seriously depleted due to price difficulties and labor shortages in both timber camps and treating plants, and with numerous roads experiencing difficulty in getting enough cross and switch ties to complete their 1946 renewal programs, the subject assigned this committee becomes increasingly important. This is true not only because of its economic aspect, but also from a standard-of-maintenance aspect, since every year of life that can be added to ties reduces the number of ties that need be produced and treated and installed.

With the recent rise in labor costs and its adverse affect upon the operating expense ratio, economies are the order of the day, and tie renewals must bear their share of these economies, while at the same time not reducing the maintenance standard of the tie portion of the track structure. Obviously, the only way this can be done is to increase tie life through a decrease in the number of tie failures.

S. H. Shepley
Chairman

Classes of Failures

Tie failures are generally recognized to fall under the following classifications: Decay, splitting, unloading damage, installation damage, mechanical wear, spike killing, derailment damage, and destruction by fire. To eliminate failures due to decay, certain methods of manufacture, inspection, transportation, seasoning, storage and preservative treatment are recommended. Briefly, the important controls to watch in order to produce a sound, decay-free tie for insertion in the track are: to winter-cut the timber, as less chance of fungi and insect infestation is apt to occur in such timber; to pile the ties free of the forest floor, in well-ventilated stacks; and then to transport the ties out of the woods as soon as possible, preferably in open cars.

Ties should be inspected for decay from the time they are cut through treatment, and properly marked for ready indentification. Almost all roads realize the importance of the thorough and comprehensive inspection of both treated and untreated crossties.

Ties for treatment should be stored on well-drained ground, free of vegetation, preferably on treated sills and in piles at least ten feet apart. Various tie species should be stacked in separate piles of as nearly as possible the same cutting date, and in accordance with standard recommended stacking practice. Ties to be used untreated should receive the same care in seasoning as treated ties. Early installation after seasoning is recommended for untreated ties.

Ties should be adzed and pre-bored prior to treatment, since this allows better penetration of the preservative in the vicinity of the spike holes where it is most needed, and at the same time allows the spikes to be driven into the ties with less damage to the wood fibres.

Vapor Seasoning

Normally, the seasoning of ties to be treated is accomplished through the climatic reduction of the moisture content of the ties. This method is still the generally accepted practice, but since it usually requires 12 to 15 months' time, depending on temperature and humidity conditions, with the attendant possibility of decay and excessive splitting, much research has been undertaken to produce artificially seasoned ties. As a result of this research, a new method of seasoning, known as the vapor-drying process, has been developed. This process accomplishes the seasoning in a matter of hours, compared with the months required by air seasoning.

Although ties treated by the vapor-drying process have been in service only a little more than two years on a southern railroad, and have shown practically no splitting, it is said that ties seasoned by this method, employing what is called the straight-cycle method, show a strength reduction of as much as 15 per cent in some species. To overcome this strength reduc-

Ties Should Be Installed with Care to Avoid Damaging Them

tion, an alternating cycle was tried, with the result that ties were seasoned with no loss of strength. However, after two years in track, ties seasoned by the alternating cycle method were found to have developed considerably more splits and checks. As a result, the straight cycle process is recommended over the alternating cycle process, despite the strength loss, which is not considered serious. If this process proves fully effective, it would appear that it will eliminate many tie failures due to splitting, and since it will allow the seasoning period to be shortened from months to hours, the possibility of decay failure will be greatly lessened.

The application of anti-splitting irons is at present the most widely used method to control splitting, and is particularly recommended for oak ties. The irons, which vary in shape, should be applied to the ties during the seasoning. Where this is not practicable, and where large splits occur, the ties should be pressed together, and steel dowels or bolts should be applied thorugh the ties at right angles to the splits, through holes bored for the purpose. The use of a chemical treatment on the end of the ties to reduce the moisture loss through the ends during seasoning is also helpful in reducing splitting.

The Size and Thickness of Tie Plates Has Increased Steadily

Treatment

Treatment should be given to ties as soon as they have been properly seasoned, to eliminate failures due to decay, to lessen the amount of splitting, and also to permit a better penetration of the preservative.

There are numerous methods of treating ties, and some roads have their own specifications in this regard. However, repeated tests have shown that for a given amount of preservative, the most effective penetration is obtained by the use of an empty-cell (Lowry or Rueping) process, than when a full-cell (Bethell or Burnett) process is used.

After the treatment is complete, the ties should be loaded compactly for shipment so they will not be damaged through shifting. When they are received, they should be unloaded carefully, and should not be dropped on one another, as additional splitting may result, or the protective shell may be punctured and allow decay to get a start.

Treated ties to be stored should be stacked perpendicular to the prevailing winds and should be covered over the top with earth to stop leaching of the preservative and to retard further drying and checking.

Damage From Tools

With the advent of heavier wheel loads and increased speeds, it became apparent that additional bearing area and better maintenance standards and practices must be provided if the advantages to be gained through carefully-controlled cutting, seasoning and treatment of ties is to be fully realized.

Care must be exercised during the process of installing or spacing ties, so as not to bruise the protective shell and thereby allow decay to start. To this end, the use of spike mauls, picks, corners of shovels, or any other sharp or pointed tools, should be prohibited, and the use of tie tongs is recommended.

Care should be exercised to drive spikes vertically, as this will result in the least damage to the tie fibres and in more uniform gage. Several types of power spike drivers are on the market, and also a spike-holding device. While these machines increase the productivity of the gang, it is necessary to have the spikes pre-set in a vertical position or as much tie damage will result from power driving as by improper hand driving.

Ties can be damaged by the use of tamping picks. Hand tamping is especially likely to cause damage. Also, the improper use of power tampers can cause much damage to the sides and lower corners of the ties.

When rail or switches are renewed, all spike holes should be plugged with creosoted tie plugs of the proper size. Using tie plugs larger than the size of the spike withdrawn will have a tendency to split the ties and will not properly plug the holes. Where rail of larger section is installed and regaging is required, it is increasingly important that tie plugs be of the correct size to fill the old spike holes, since otherwise the new spikes will tend to run into the unfilled portions of the old holes. This is apt to cause tight gage, with the necessity of respiking and resultant additional tie damage.

When adzing ties, either by hand or mechanical means, the surface cut should be coated with creosote or other wood preservative. If creosote is applied during cold weather, it should be heated before application.

Care in Track

Assuming that all seasoning, treating, unloading and installing have been completed, and that a sound, undamaged tie is in the track, it now becomes the maintenance of way man's problem to get the full expected life out of the tie. Careful inspection to determine the yearly tie renewal requirements is essential so that ties are not removed prematurely, and also to insure that the overall condition of the ties in each panel is as nearly uniform as possible. Uniform tie support is important if some ties are not to receive more load than adjacent ties, and hence be subject to increased mechanical wear. Some roads resort to a special tie marking system to accomplish this, while others leave the actual tie renewals up to the judgment of the section foreman and supervisor. Both methods, however, should be aimed at getting the maximum life out of each tie, while still maintaining a uniform tie support.

The size and thickness of tie plates has increased steadily until a 7⅛-in. by 18-in. plate, 1 in. thick, has been adopted by some roads with the hope that failures due to mechanical wear can be cut to the minimum. The cant and eccentricity of the tie plate should be studied carefully along with increased size and thickness, with the ultimate goal of producing a plate that has uniform unit bearing pressure on the tie.

The method of fastening tie plates to the ties has a very definite effect on the rate of mechanical wear of ties. Many different arrangements of fastenings have been tried, including cut spikes, screw spikes and double-coil spring washers, spring-type spikes, and rail clips of various designs. All of the methods are helpful in reducing mechanical failure of the ties; however, much of the benefit gained can be lost if, when a different rail section is used, regaging is required.

Great improvement has been made in the field adzing of ties in conjunction with rail-laying operations. The power adzer is not only a saver of man-hours of labor in itself, but, by producing a clean-cut level surface on which to place the tie plates, and subsequently the rail, minimizes mechanical wear of the ties.

On curves where it is difficult to maintain gage, and where excessive wear is occurring on the high rail, or excessive flattening is occurring on the low rail, study should be made of actual train speeds to determine

whether these speeds differ to any large extent from the speed for which the curve has been super-elevated. More often than not under these conditions, actual operating speeds will be found out of balance with the elevation that has been provided. If the super-elevation can be balanced more nearly with the tonnage and speed over the curves, rail wear or damage, regaging, plate cutting and spike killing will be reduced.

Tie failures within turnouts, due to mechanical wear and spike killing, can be reduced by the use of thicker and larger slide plates and adjustable braces. Likewise, the use of adjustable connecting rods and adjustable eye bolts on switch stands will do much to save the head blocks from spike killing.

Clean Ballast

While all of the above mentioned improvements in maintenance have a tendency to prolong the life of ties, much of their advantage will be lost if proper attention is not given to the condition of the ballast, on which the ties rest and to which they must transmit their loads. One can hardly expect to get the maximum service life from ties with foul, churning ballast, and joint ties that flop under each wheel. Under these conditions, the joint ties, which represent approximately 20 per cent of the tie structure, are prematurely subject to mechanical failure. It is easily understandable that during the last four years, with their depleted maintenance forces and increased traffic, the general standard of ballast, surface and line has dropped, and must now be brought up to standard by an extensive surfacing program if the effects are not to show up in increased tie failures.

Drainage of the ballast and subgrade is high on the list of tie-failure preventatives. To improve the track structure, drainage and roadbed stabilization should be studied carefully. Clean, wide ditches, with sufficient gradient to get the surface water away from the track quickly, should be provided. Cross drains are also necessary in many cases.

Sound, well-graded ballast, with a minimum of fines, should be used, as this will allow surface water to get out of the ballast quickly, and at the same time will not foul readily.

Welded Rail

To decrease tie failures at joints, and especially in territories where traffic justifies the installation, serious thought should be given to continuous welded rail. While welded rail has not been in service long enough to permit the evaluation of all its advantages or disadvantages, it is generally agreed that through its use joint maintenance stops and tie life is increased. Many roads are using welded rail through highway crossings to reduce otherwise excessive joint and tie maintenance.

In conclusion, it seems that methods of tie production and treatment are ahead of the standards of track maintenance on the railroads, with the result that further methods of overcoming tie failures rest largely with track maintenance officers through increased refinement of the track structure and the application of known devices and methods to this end.

Discussion

H. R. Duncan (C.B. & Q.), referring to the winter cutting of timber for ties, said that, although this practice is highly desirable, climatic conditions in many parts of the country render it impractical. He also stated that, for reasons of economy, the practice on his road is to store treated ties on concrete-block sills, rather than on treated timber sills. Mr. Duncan then took exception to the use of untreated ties in certain instances, pointing out that this practice cannot be justified economically. W. H. Sparks (C. & O.) made an appeal for larger tie plates, attributing a large number of tie failures to the use of the smaller plates. He concluded his comments by stating that treated ties should be adzed by mechanical means only.

Committee Personnel

S. H. Shepley (chairman) div. engr., E. J. & E., Gary, Ind.; C. Miles Burpee, (vice-chairman), vice-pres. Simmons-Boardman Publishing Corp., New York; S. J. Caesar, trk. supvr., C. W. P. & S., Chicago; H. E. Carter, rdm., N. & W., Petersburg, Va.; Paul H. Collins, rdm., S. P., Dunsmuir, Cal.; J. C. Cooper, rdm., Virginian, Roanoke, Va.; W. J. Daehn, rdm., C. & N. W., Sparta, Wis.; John E. Fault, rdm., C. I. & L., Lafayette, Ind.; J. G. Gilley, div. engr., C. & O., Richmond, Va.; J. E. Greenfield, trk. supvr., A. T. & S. F., Sweetwater, Tex.; C. Halverson, div., rdm., G. N., Willmar, Minn.; T. R. Klingel, maint. engr., M. St. P. & S. S. M., Minneapolis, Minn.; F. J. Meyer, ch. engr., r. r. div., Philadelphia Steel & Wire Co., Philadelphia, Pa.; J. Morgan, supvr. trk., C. of G., Leeds, Ala.; J. A. Rust, rdm. Sou., Greenville, S. C.; R. G. Simmons, gen. trk. insp., C. M. St. P. & P., Chicago; Lee Spencer, rdm. (retired) L. I. R. R., Phoenix, Ariz.; I. D. Talmadge, rdm., L. & H. R., Warwick, N. Y.; B. O. Webb, supvr., N. C. & St. L., Bruceton, Tenn.; A. A. Witter, supvr. trk., I.C., Carbondale, Ill.

ROADMASTERS

Supply Associations Hold Large Joint Exhibit at Conventions

FROM September 16 to 19, inclusive, the Track Supply Association and the Bridge and Building Supply Men's Association held a joint exhibit of materials, tools and equipment at the Hotel Stevens, Chicago, in conjunction with the concurrent annual conventions of the Roadmasters' and Maintenance of Way Association and the American Railway Bridge and Building Association. The exhibit was unique in that it was the first such "double-headed" affair held by the two supply organizations, and that it was a success is evidenced in the fact that 90 companies were represented.

The officers of the Track Supply Association who were responsible for the planning, preparation and conduct of the track phases of the exhibit this year were: President, H. C. Hickey, The Rail Joint Company, Inc., Chicago; first vice-president, M. H. McFarlane, O. F. Jordan Company, East Chicago, Ind.; second vice-president, J. B. Templeton, Templeton, Kenly & Co., Chicago; secretary-treasurer, Lewis Thomas, general sales manager, Q & C Co., Chicago. Directors, H. E. Kirby, assistant engineer, Chesapeake & Ohio, Richmond, Va. (honorary); C. O. Jenista, Barco Manufacturing Company, Chicago; L. I. Martin, Morden Frog & Crossing Works, Chicago; Kenneth Cavins, Fairmont Railway Motors, Inc., Chicago; T. E. Rodman, Maintenance Equipment Company, Chicago; R. W. Torbert, Oxweld Railroad Service Company, Chicago; and Edward Wray, Purchases and Stores, Chicago.

Likewise, the officers of the Bridge and Building Supply Men's Association who arranged for the exhibits of the members of their associations were: President, G. B. Coffey, A. M. Byers Company, Chicago; vice-president, W. L. McDaniel, Massey Concrete Products Company, Chicago; treasurer, G. R. Betts, Armco Drainage and Metal Products, Inc., Chicago; secretary, E. C. Gunther, Duff-Norton Manufacturing Company, Chicago. Directors, R. Y. Barham, American Rolling Mill Company, Chicago (honorary); G. W. Morrow, Worthington Pump & Machinery Corp., Chicago; S. W. Hickey, *Railway Engineering and Maintenance*, Chicago; C. E. Croisant, Lehon Company, Chicago; and Howard Mull, Warren Tool Corporation, Chicago.

In the election of officers of the Track Supply Association, which was held on Thursday of the convention week, Mr. McFarlane was advanced to president, and Mr. Templeton to first vice-president; Mr. Cavins was transferred to second vice-president, and Mr. Thomas was re-elected secretary-treasurer. The new directors are W. A. Peck, The Rails Company, Chicago; J. F. Van Nort, Duff-Norton Manufacturing Company, Chicago; and W. A. Enstrom, P. & M. Company, Chicago.

In the election of officers for the Bridge and Building Supply Men's Association, Mr. McDaniel was raised to president; Mr. Mull was elected vice-president, and Messrs. Gunther and Betts were re-elected secretary and treasurer, respectively. The new directors chosen are L. R. Robinson, Pittsburgh Pipe Cleaner Company, Pittsburgh, Pa., and R. W. Torbert, Oxweld Railroad Service Company, Chicago, while Mr. Coffey, the retiring president, becomes honorary director.

A list of the exhibiting companies, the names of their representatives present, and the products on display follows:

Exhibiting Members

Air Reduction Sales Company, New York—C. A. Daley, M. C. Brink, J. W. Kenefic, U. F. Portell, W. Whaley, D. J. Williams—Gases, welding and cutting apparatus; rail cropping apparatus; rivet washing apparatus; flame cleaning apparatus; welding and brazing rods and fluxes.

American Brake Shoe Company, Ramapo Ajax Div. Chicago—J. S. Hutchins, G. A. Carlson, R. Carmichael, C. P. Corrigan, C. E. Godfrey, B. R. Habel, J. V. Houston, A. F. Huber, O. F. Magnus, W. A. Maxwell, E. F. Needham, Jas. McComb—No exhibit.

American Fork & Hoe Co., The, Cleveland, Ohio—Frank J. Reagan, C. C. Connolly, S. L. Henderson, J. J. Nolan, D. L. O'Brien, John Skeel, R. J. Whalen—Stead rail anchors; True Temper rail joint shims; True Temper safety rail fork.

American Lumber & Treating Co., Chicago—R. R. Clegg, F. W. Gottschalk, Henry Garnjobst, R. B. Putman, R. E. Davis—Samples of Wolmanized, Minalith and creosoted lumber; display pictures.

Armco Drainage & Metal Products, Inc., Middletown, Ohio—G. R. Betts, C. H. Anderson, H. S. Claybaugh, E. T. Cross, V. W. Davis, J. D. Faylor, W. H. Spindler, Felix Truss, C. M. Colvin, N. A. Powell, Wm. Robertson, R. N. Tracy, Geo. H. Brown, A. J. Mistler, Perk Baird, A. H. Baldwin—Corrugated metal culverts; corrugated pipe arches; multi-plate pipe and pipe arches; perforated corrugated pipe; spiral welded pipe; quick coupling pipe; bin-type retaining walls; standard metal buildings; tunnel liner plates; steel sheeting; guard rail.

Austin-Western Company, Aurora, Ill.—Jess Mossgrove, H. B. Bushnell, George Sines—Model of a railroad-type 30 yd. air-dump car and photographs.

Barco Manufacturing Company, Chicago—C. O. Jenista, F. N. Bard, W. J. Behlke, R. F. Ingebretsen, W. T. Jones, L. J. Lytle, J. L. McLean, C. L. Mellor—Gasoline-operated tie tampers, paving breakers, hammers and rock drills.

Bernuth, Lembcke Company, Inc., New York—A. C. Jack, W. A. Fisher—Elastic spike; tie plate hold down spike; Utmost spike; clamp plate.

Buda Company, The, Harvey, Ill.—R. B. Fisher, E. J. Broholm, H. H. Cohenour, R. K. Mangan, R. J. Mulroney, D. Richards, M. J. Rotroff, J. W. Sanford, R. P. Williamson, H. A. Wolfe—Rail bender; power track drill; alloy track jack; earth drill; Diesel nozzle testor; hand track and bonding drills; track liner; track jacks; journal jacks; Kunch Klaws jack; hyrdaulic jacks; self-lowering jacks.

Cartier Supply Company, Chicago—V. G. Cartier, W. A. Peck—One-man track tool.

Chicago Pneumatic Tool Company, New York—H. R. Deubel, J. J. Brown, C. L. Butler, S. A. Congdon, J. E. Hopping, W. Pallowick, E. S. Rosselle, J. Kacmarik, T. P. Harris—All air-colled compressor tie tamper; pneumatic drills; gasoline tie tamper; rock drills; impact wrenches; riveting hammer; rivet buster; electric tools.

Chicago Steel Foundry Company, Chicago—Capt. C. McA. Evans, David Evans, C. K. Garrison, R. L. Otremba, F. J. Ludera,—Track liner; journal boxes; couplings; blower nozzles; rail clips; locomotive bin feed screws; swing hanger; truck columns.

Chipman Chemical Company, Inc., Bound Brook, N. J.—N. J. Leavitt, L. A. Elson, C. S. Langdon, A. J. Reading—No product.

City Sales Company, Chicago—R. F. Lindrooth, H. J. Wilkin, R. Lindrooth—Power weed mowers; electric hedge and grass trimmers.

Crerar, Adams & Co., Chicago—Geo. J. Doyle, T. J. Connally, A. Kopala, O. C. Liesendahl, H. C. White—Track tools; track jacks; bonding drills; track drills; shovels; ballast forks; tool handles; electric hand saw and drills; pneumatic hand saw; die starters.

Cullen-Friestedt Company, Chicago—F. P. Cullen, L. B. Bertaux, C. J. Bronez, E. V. Cullen, K. J. Huybers, Jos. F. Leonard, D. L. O'Brien, G. G. Prest—Motion pictures of crane in operation; rail tongs.

Dearborn Chemical Company, Chicago—C. C. Rausch, D. B. Bishop, Howard E. Johnston, Dan Powers, Frank H. Kuhlmann—Rust preventives and wrappers; sealing compound for wood water tanks; material for waterproofing concrete structures.

A. P. deSanno & Son, Inc., Phoenixville, Pa.—E. J. Rohan, A. P. deSanno, Jr., C. H. Davis, G. E. Lipp, D. F. Madigan, Jr.—Grinding wheels.

Duff-Norton Manufacturing Company, The, Pittsburgh, Pa.—J. F. Van Nort, E. C. Gunther, N. A. Sinclair, Robt. Lear—Bridge and building jacks; track jacks.

Electric Tamper & Equipment Company, Ludington, Mich.—H. W. Cutshall, A. W. Davis, G. H. Haywood, J. F. Hensel, R. F. Hermann, M. E. Johnson, George J. Morris, H. D. Piper, J. M. Webb, M. S. Westlund, A. del Paso—Electrical tie tampers and concrete vibrators.

Eutectic Welding Alloys Corporation, New York—W. R. Bajari, A. O. Hazzard, J. R. Koske, A. C. Larweth, P. E. Miller, W. H. Stephenson, Albert E. Zeisel—"Low-temperature" welding alloys and fluxes; the true weld without fusion.

Evans Products Company, Detroit, Mich.—F. A. Keihn, Robert H. Gass, W. E. Kimberlin, C. H. Griffis—Auto-Railer maintenance of way truck; Auto-Railer officials inspection car.

Fabreeka Products Company, Inc., Chicago—A. E. Bardwell, W. P. Brennan, F. A. Hoffmann, R. R. Howard, S. S. Maurer, F. B. Summers, Jr.—Track, bridge and turntable pads.

Fairmont Railway Motors, Inc., Fairmont, Minn.—Kenneth Cavins, George F. Adams, J. B. Akers, Jr., O. F. Banke, W. A. Banke, Clyde P. Benning, C. W. Brhel, W. D. Brooks, O. F. Buscho, C. J. Dammann, D. E. Doolittle, I. N. Eustis, R. B. Evans, C. F. Green, C. H. Johnson, W. F. Kasper, Fred A. Kaup, N. J. McDonald, John T. McMahon, R. W. Payne, Charles Rager, W. H. Ripken, F. G. Simmons, Harmon Sly, R. W. Stenzel, Ira Sublett, J. P. Wainscott, W. M. Williamson, W. Conroy Wilson—Standard section car; inspection car with cab; gang or B&B motor car; grouting car; spotboard; bolt breaker; right-of-way torch; cut-away inspection car engine; inspection car engine with self starter; wheel axle and bearing display.

Filkins & Son Co., Chicago—A. J. Filkins, E. M. Filkins—No product.

Hayes Track Appliance Company, Richmond, Ind.—

Homelite Corporation, Port Chester, N. Y.—Nelson Thompson, T. W. Gramm—Portable gasoline-engine driven self-priming centrifugal pumps; portable gasoline-engine driven generators with tools and flood lights; portable gasoline-engine driven blower.

Hubbard & Co., Chicago—A. C. Laessig, N. A. Howell, A. L. Fridley—Tools; spring washers; rail anchors.

Illinois Malleable Iron Company, Chicago—Dayton T. Hogg, Albert Ericson, Chas. G. Ericson, Eugene C. Mann, L. O. Stratton—Rail anchor; bridge clamping washer.

Independent Pneumatic Tool Company, Chicago—W. A. Nugent, J. A. Bell, H. H. Ritchotte, F. J. Schiel, Mark Sorenson, J. Hill—Portable pneumatic and electric power tools; pneumatic spike drivers; pneumatic impact wrenches; pneumatic and electric saws; pneumatic riveting, chipping and scaling hammers; pneumatic and electric drills, wood borers; pneumatic and electric grinders.

Ingersoll-Rand Company, New York—H. L. Kent, R. C. Baldwin, E. L. Hawes, E. L. Nelson, T. Weigand, John Hansen—Spottamper compressor; pneumatic tie tampers; spike drivers; track wrenches; pneumatic tools.

Johns-Manville, New York—Thomas O'Leary, G. J. Campbell, S. M. Eaton, J. I. Farrell, H. J. Landis, W. G. Morehead, R. J. Offutt, K. J. Oswald, A. C. Pickett, W. W. Prosser, F. C. Vandervort, L. T. Youhn, F. Fix—Transite pipe; Transite corrugated; Transite flat; Transite shingles; asbestos pipe covering; asbestos packing; asbestos roofing materials.

O. F. Jordan Company, East Chicago, Ill.—H. M. McFarlane, A. W. Banton, J. J. Dudzinski, J. C. Forbes, W. J. Riley, C. W. Shipley—Model of spreader-ditcher.

H. C. Hickey
President

Lewis Thomas
Secretary

Track Supply Association

G. B. Coffey
President

E. C. Gunther
Secretary

Bridge and Building Supply Men's Association

E. B. Kaiser Company, Chicago—E. W. Kaiser, A. G. Kaiser, M. B. Kaiser, C. E. Finger, W. Hubbard, G. Piller, A. Stockenberg—Underground conduits; jacket piping; lead-lined piping and fittings; heat exchangers.

Kalamazoo Manufacturing Company, Kalamazoo, Mich.—R. E. Keller, Lawrence Boswell, G. E. Bridge, Geo. W. Hoover, Geo. E. Monroe, Thomas Tough, Henry Vogel—Light-weight section motor car; supervisor's combination gage and level; A.R.E.A. track gage; A.R.E.A. track level.

Kershaw Company, The, Montgomery, Ala.—Royce Kershaw, Knox Kershaw, John P. Crow—Cribbing machine; rail derrick; spike setting and distributing carriage.

Koehring Company, Milwaukee, Wis.—J. R. Steelman, John Poulter, J. F. Robbins, R. E. Stewart—Railroad mud jack.

Lehon Company, Chicago—C. E. Croisant, T. L. Connolly, J. E. Eipper, Tom Lehon, A. C. Senseney, John W. Shoop, E. A. Loenard—Roofing and waterproofing products.

Le Roi Company, Chicago—George M. Hogan, R. E. Bell, C. W. Brown, G. M. Dallas, J. G. Dear, J. M. Dolan, James T. Flynn, D. E. Fricker, K. E. Gifford, Donald J. Hogan, J. E. Hogan, D. L. O'Brien, L. O. Stratton—5 kw. generator; Diesel rail car compressor; combination tractor compressor.

R. G. LeTourneau, Inc., Peoria, Ill.—Geo. Crafton, S. D. Means, E. E. Weyeneth, J. L. Nordine, V. Pray, C. D. Fey—High-speed rubber-tired scraper; wire rope.

Link-Belt Speeder Corporation, Chicago—Robert B. Barnes, B. V. Jones, G. H. Olson, K. R. Merrick—Speeder crawler-mounted scale model of 1½-yd. shovel; display pictures of cargo cranes, crawler draglines and clamshell machines.

Lundie Engineering Corporation, The, New York—L. B. Armstrong-Tie Plate; rail lubricator; safety tongs; spring rail clips.

Maintenance Equipment Company, Chicago—T. E. Rodman, E. Overmier, P. A. Wells, Jr., H. V. West, Jr., P. J. Wolf—Rail and flange lubricator; derail; switch-point protector.

Mall Tool Company, Chicago—A. O. French, W. Friedrich, E. M. Larson, D. Soderberg, A. W. Mall, R. Ross, R. Schwass—Portable power tools; chain saws; gasoline and electric vibrators; electric saws; electric drills.

Marvel Equipment Company, Chicago—A. M. Anderson, O. E. Quinton, John R. Thorp—Propane switch heater; commercial gas switch heater; oil (wick-type) switch heater; electric switch heater; kerosene torches.

Massey Concrete Products Company, Chicago—W. Lyle McDaniel, Ross Clark, J. A. Higgs—No products.

Master Builders Company, The, Cleveland, Ohio—B. R. Wood, V. S. Andrews, G. F. Geils, D. Clifford, C. A. Lyon, C. W. Alverson—Cement dispersing agents; non-shrink aggregates; metallic floor hardeners; chemical floor hardeners; colored floor hardeners.

Mississippi Supply Company, Chicago—W. S. Gilpin, R. E. Long, H. A. McCloud, Otto Orlich, Frank S. Williams—Switch heaters; saw blades.

Modern Railroads Publishing Company, Chicago—D. R. Watson, Harry Brown, Kenneth Kruse, Frank Richter, Harold L. Stuart—Copies of magazine.

Morden Frog & Crossing Works, Chicago—Lyle I. Martin, W. Homer Hartz, George F. Killmer—Taper rail; compromise angle bars; adjustable rail brace; miscellaneous forgings, including rail braces; milled and rolled riser slide plates.

Morrison Railway Supply Corporation, Buffalo, N. Y.—George E. Diver, E. W. Smith, David Vogel, J. B. Wright—Switch-point guard; gage holder; track stabilizer; pile shoe; Osmasalts for new lumber; Osmaslastics for poles and piling joinery work.

Murdock Manufacturing & Supply Company, Cincinnati, Ohio—J. Kelso Murdock, Thomas E. Bart—Boxless-type railroad water service fixture.

Nordberg Manufacturing Company, Milwaukee, Wis.—H. H. Talboys, J. B. Akers, Jr., Goerge M. Cooper, George M. Dallas, J. R. Graham, Stan H. Haigh, James F. Hartley, John E. Hogan, W. S. Isaacs, Clyde K. Jensch, Eugene Larson, Ralph W. Payne, H. W. Protzeller, Lloyd O. Stratton, W. Conroy Wilson—Cribbing machine; spike hammer; rail grinders; gage bar.

Northwestern Motor Company, Eau Claire, Wis.—F. W. Anderson, Otis B. Duncan, Wm. B. Joyce, A. H. Nelson, George G. Prest, Gilbert Heithaus, C. E. Murphy, Milton W. Allen—Heavy-duty track motor car; section track motor car; light section track motor car; inspection track motor car.

Oliver Corporation, The, Cleveland, Ohio—W. E. Miles, H. W. Davis, W. F. Winkler—Industrial wheel tractor; industrial crawler tractor equipped with a front-end loader.

Oliver Iron & Steel Corporation, Pittsburgh, Pa.—Carl Wingerson, J. C. Cullinan, Edward M. Welty—Gage rods; screw spikes; hold-down drive spikes; tie-plate drive spikes; frog bolts; heel-block bolts; switch bolts; plow bolts; track bolts; square and hex. nuts; timber grips; timber drive spikes.

D. W. Onan & Sons, Minneapolis, Minn.—Perry W. Copeland, Hiram W. Hascall—4000-watt direct-current generating plant; 1500-watt direct-current generating plant; 10 hp. commercial engine.

Overhead Door Corporation, Hartford City, Ind.—Robert E. Myers—Railroad overhead door.

Oxweld Railroad Service Company, The, Chicago—R. W. Torbert, Lem Adams, G. P. Bogert, M. Burnett, Jr., W. E. Campbell, H. V. Gigandet, F. J. Graham, E. B. Hall, Jr., F. C. Hasse, J. W. Lacey, P. T. Mckinney, H. R. Miller, G. B. Moynahan, D. H. Pittman, J. H. Rodger, J. E. Winslow—Cutting and welding blow pipes; flame-cleaning, gouging, heating and other special-purpose nozzles; pressure regulator for oxygen and acetylene; cutting machine; acetylene floodlights; track specimens-pressure weld, flame-hardened, built-up rail ends, flame-straightened joint bars; wrinkle-bent and welded pipe; motion pictures of Oxweld's maintenance of way processes.

P. & M. Company, Chicago—John E. Mahoney, D. M. Clarke, William Garrity, P. H. Hamilton, Geo. E. Johnson, Max K. Ruppert, R. C. Schultze—Rail anti-creepers.

Pettibone-Mulliken Company, Chicago—G. J. Slibeck, W. A. Blackford, W. F. Brietzke, W. A. Enstrom, E. C. Phillips—Mechanical switchman; hydraulic retarders for spring frogs; automatic switch stand; heavy-duty switch stand; manganese steel rerailers; cribbing equipment; forged adjustable rail braces.

Pittsburgh Pipe Cleaner Company, Pittsburgh, Pa.—L. R. Robinson, B. W. Dougherty, E. C. McFadden, Fred C. Morris, R. T. Ruder, R. H. Williams, Paul Bhame, Barney Noel—Mechanical pipe cleaning equipment.

Pocket List of Railroad Officials, The, New York—B. J. Wilson, Harold A. Brown—Copies of Pocket List of Railroad Officials.

Power Ballaster Company, Chicago—F. H. Philbrick, S. E. Bates, S. Bates, Jr.,—Motion pictures of equipment in action.

Q and C Company, The, New York—Lewis Thomas, M. Iseldyke, Jr., L. E. Hassman, G. G. Prest—Switch-point guard; guard-rail clamp; car stop; car derailer; rail tongue; track-gaging tool; tie rods; compromise joints.

Racine Tool & Machine Company, Racine, Wis.—H. A. Schultz, George Christiansen, M. E. Erskine, E. R. Larson, E. L. Clark, J. E. Erskine, R. V. Hill, E. R. Mason—Portable rail cutters; gasoline-driven bonding drill.

Rail Joint Company, Inc., The, New York—H. C. Hickey, Alex Chapman, E. A. Condit, G. H. Larson, J. N. Meade, R. W. Payne, Thomas Ryan, N. H. Snyder, H. L. Lansing, Tom Moore, R. W. J. Harris, W. J. Acker—Rail joints; compromise joints; insulated joints; fibre insulation.

Railroad Equipment, Chicago—Roy Gurley, Mrs. Lucille Johnson—Copies of magazine.

Railroad Products Company, Cincinnati, Ohio—Jas. W. McGarry, Otis B. Duncan, Dan J. Higgins, George G. Prest—Hydrant; high-pressure lubricator, ball and swing joints.

Rails Company, The, New Haven, Conn.—Lester T. Burwell, R. E. Bell, R. H. Bell, F. W. Gale, F. W. Holstein, W. A. Peck, J. V. Wescott, Garwood Burwell—Compression rail anchor; Hot-Trac snow melter; bridge tie anchor; automatic switch point lock; M. & L. track construction; compression screw spike; full-throated cut spike.

Railway Engineering and Maintenance, Chicago—S. W. Hickey, G. E. Boyd, M. H. Dick, R. E. Dove, W. G. Downie, N. D. Howard, P. D. Juraschek, F. C. Koch, H. E. McCandless, C. W. Merriken, Jr., J. M. Rockwell, F. W. Smith, W. L. Turner, Jr., C. A. Zehner—Copies of magazine.

Railway Maintenance Corporation, Pittsburgh, Pa.—Robert M. Jenner, M. Bauer, John F. Casey, Jr., G. H. Hogan, J. B. McWilliams, J. E. Mountford, J. J. King—Ballast mole; rail joint packing.

Railway Purchases and Stores, Chicago—Edward Wray, J. P. Murphy, K. F. Sheeran—Copies of magazine.

Railway Trackwork Company, Philadelphia, Pa.—Wm. D. Hoffman, John Moore—Grinding machines; track drill.

Reade Manufacturing Company, Chicago—Chas. F. Reade, Chas H. Reade, D. M. DeWitt, C. A. Parish, Tom Moore, Harold Sjoblom, John Stalzle—Chemical weed killer; integral waterproofing (concrete).

Rust-Oleum Corporation, Evanston, Ill.—Jos. C. Simmons, Waldo E. Bugbee, C. E. Murphy—Rust preventive.

Snap-On Tools Corporation, Kenosha, Wis.—M. B. Steinmetz, F. M. Lourigan, W. E. Earl, Richard Sorenson, D. A. Cook—Hand tools.

Sperry Products, Inc., Hoboken, N. J.—S. P. Murphy, J. M. Dickey, T. E. Gilhooley, W. P. Morrison—Sections of defective rails.

Syntron Company, Homer City, Pa.—Ural Martin, D. C. Black, Chetwin Hurd, Dick McHale—Gasoline paving breakers; gasoline spike drivers.

Taylor-Colquitt Company, Spartanburg, S. C.—William E. Gadd, J. F. Renfro, A. B. Taylor, Jr.—Section of crosstie treated by the vapor-drying process.

Templeton, Kenly & Co., Chicago—J. B. Templeton, Haig C. Dilsizian, R. B. Hill, F. J. Jakoubek, A. C. Lewis, G. G. Prest, L. F. Roehl, E. T. Scott, W. Simpson, Alvin M. Smith, N. L. Montgomery—Jacks; tie spacers; track shifters.

Timber Engineering Company, Washington, D. C.—R. L. Fletcher, L. P. Keith—Flanged clamping plate; flat clamping plate; spike grids; toothed rings; split rings; shear plates.

Union Metal Manufacturing Co., The, Canton, Ohio—J. R. Burkey, M. B. Grant, J. W. Lewis, W. H. Robertson, D. T. Greth—Fluted steel piling.

Unit Crane & Shovel Corporation, Milwaukee, Wis.—Jack Lumley—Model of crane.

Warner & Swasey Company, Gradall Division, Cleveland, Ohio—S. F. Beatty, Jr., T. W. Kennedy—Motion pictures of Gradall earth moving equipment.

Warren Tool Corporation, Chicago—Howard Mull, Carl F. Baumann, Oscar W. Youngquist—Railroad track tools.

Woodings-Verona Tool Works, Woodings Forge & Tool Co., Chicago—R. J. McComb, H. W. Carr, C. L. Luyster, J. B. Martin, W. H. Woodings, J. M. Moore, G. L. McKewin—Anchors and Triflex joint springs.

Woolery Machine Company, Minneapolis, Minn.—W. F. Woolery, R. J. Moe, H. M. Woolery—Weed burners; creosote sprayers; combination tie-cutter and tie scorer.

Worthington Mower Company, Stroudsburg, Pa.—Les C. Meskimen—Power sickle mower.

Worthington Pump & Machinery Corp., Holyoke, Mass.—George W. Morrow, J. S. Bachman, J. S. Clinger, W. H. Duffill, W. J. Fleming, B. T. LaPierre, H. J. Schultz, J. S. Hazen—Non-tilt concrete mixer; Handiair portable railroad compressor; portable self-priming centrifugal pumps; grout injector and accessories; air tools including tie tampers, paving breakers, hand-held rock drills, tampers, clay spades.

What's the ANSWER?

How Much Ballast on Bridges?

What is the minimum depth of ballast on which track can be maintained satisfactorily on ballast-deck bridges? In what way does this differ from ordinary track? Does the kind of ballast make any difference?

Uses Six Inches

By S. F. Grear
Assistant Engineer of Bridges, Illinois Central, Chicago

Our standard ballast-deck trestles have decks 12 ft. wide, with 10 stringers to the panel, for each track, and 4-in. deck plank. We use 6 in. of ballast under the tie, and I believe that this is the minimum amount with which to obtain satisfactory distribution of the load over the stringers. In some cases, particularly on branch lines, we find less than 6 in. of ballast under the ties, but this does not seem to result in any worse conditions with respect to track maintenance. On the other hand, we do not believe that we are getting the track load distributed as it should be.

When ballast is carried on concrete, the same conditions exist with respect to distribution. If the ballast is on waterproofing, 6 in. of ballast is especially needed to prevent damage to the waterproofing by reason of the operation of tamping tools. When the ballast is supported on a firm unyielding base, such as is provided by the ballast-deck construction, the track does not need so great a depth of ballast as is required on ordinary earth subgrade.

So far as depth is concerned, I do not see that this will depend in any way upon the kind of ballast. All ballast on bridges should be of a type to give good drainage.

While this matter is not covered by the question, there is also the problem of too much ballast. There is always a tendency to keep raising track in surfacing and ballasting and the easiest method is always to carry these raises across the ballast-deck bridges. In time this results in overloading the ballast retainers, and in even overloading the stringers or other parts of the structure. In general, I recommend that ordinary timber pile ballast-deck trestles should not have more than 12 in. of ballast under the ties. The allowable depth on a concrete or steel bridge will, obviously, depend on the design.

Depth Highly Important

By General Inspector of Bridges

I am glad to see this question published, for I consider the question of depth of ballast on ballast-deck bridges to be an important but usually ignored subject. However, the question is not quite complete, for I am sure that maximum depth is of equal importance with minimum depth.

To go to the last query here, my experience does not qualify me to say whether the kind of ballast makes any difference, because we use only a hard not-easily pulverized broken stone on all our ballast decks whether they be on main tracks or branch lines. I am prepared to say, however, that any ballast that breaks up easily and pulverizes with tamping is not suited for use on ballast-deck bridges. Neither is any other material that contains a large percentage of fines which may aid in blocking drainage, for good drainage through the ballast is a condition precedent to good track over the bridge.

Obviously, the function of the ballast is to distribute the traffic loads to

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Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered In December

1. *To what extent is it desirable or economical to widen cuts or flatten the cut slopes to prevent accumulations of snow? How can this best be done?*

2. *To what extent can aluminum be used in the construction and modernization of railway buildings? For what purposes? What are the advantages?*

3. *Is it feasible to assign men in extra gangs to certain kinds of work permanently? How should they be selected? What are the advantages? The disadvantages?*

4. *Is it permissible to apply anti-creepers on open-deck trestles? On steel bridges? Does the length of the trestle or of the span make any difference? Why? How many should be applied? How can the ties be held in place?*

5. *What considerations should govern the retirement of power machines? Power tools? To what extent should obsolescence be taken into account?*

6. *Is it practical to salvage parts from pumps that are to be scrapped? Is it economical? Why? What precautions should be observed?*

7. *Are there any advantages in the use of oversized cross ties? Undersized ties? Any disadvantages? Why? Does the volume of traffic or kind of ballast make any difference?*

8. *What troubles should be guarded against in the operation and maintenance of ventilators during the winter? Why? Does the character of the building or its use make any difference?*

the stringers as nearly uniformly as practical, so that each will bear its due portion of the total load. I have never made any calculations or conducted any experiments to determine exactly what this depth is. However, we endeavor to maintain a minimum of 8 in. under the ties on the theory that this will give us the desired distribution. Any greater depth is, to my mind, a complete waste of material, which adds up to a surprising amount where all the bridges on the system are included.

Furthermore, any depth greater than that needed for full distribution adds to the load the bridge must carry; it complicates the job of keeping the ballast clean, and is entirely out of balance so far as the functioning of the ballast retainers is concerned. This is a matter that should be given greater consideration by both the bridge and the track department.

When Inspecting Roofing

What details should be given particular attention when making an inspection of roofing?

Fail at the Same Places

By G. V. Coffey
Supervisor Bridges and Buildings, New York Central, Jackson, Mich.

Four types of roofing are in general use today, namely, the built-up type, metal roofing, tile or shingles of various types, and roll roofing. Inspection of these different types does not vary greatly, however, for they all fail at the same vital places.

Most minor defects or approaching failures can be caught and corrected before serious damage has occurred to either the roof or the entire structure, thus saving the cost of major repairs or extensive renewal. To this end inspections at regularly-scheduled intervals can be made methodically regardless of the type of roof in use.

To inspect a roof satisfactorily, the inspector must go onto the roof, but since this often presents a safety hazard, he should by all means have available the necessary ladders, rope, toe boards, handlines and such help as he may need to carry out the inspection. Roof failures generally follow definite patterns, and occur in the following order, valleys, flashings, wearing surfaces, ridges and hips, nosings and gutter aprons and decking. So far as practicable, this order should be followed in making the inspection.

Valleys should be examined for cracks or, in metal valleys, for broken seams or joints pulled apart. They should be free of obstructions and debris of the character that generally collects in them. Unless cleaned out, this material will dam up the water, forcing it back under the roofing beyond the apron of the valley. This will result in a reported leaky roof and will tend to hasten decay or failure of the roof decking.

Flashings, especially those on large buildings such as comprise numerous groups of railway structures, become particularly important. Furthermore, it is often necessary to apply flashings to different materials and different forms of construction on a single building. It occurs frequently that leaks through flashings may follow the roof deck or some member and appear at a point widely separated from the point of entry. Too much attention cannot be given to flashings.

Main roof or wearing surfaces should be checked for broken, missing or loose tile and shingles, for blisters, worn spots, loose or floppy areas and for wrinkled and buckled areas in built-up or asphalt roll roofing; for pulled or broken seams; for corroded or pitted sheets and for holes from other causes in metal roofs; for curling and brittleness in asphalt shingles; and for gravel distribution on tar and gravel roofs. The dryness of felts in built-up roofs should be checked.

Ridges and hips should be examined for broken, missing or uncalked tile and for pulled felts. Nosings and gutter aprons should be anchored solidly, since wind damage usually starts here. The deck should be examined for decayed, split and badly-checked boards, for spalled, cracked and disintegrated concrete, and for deteriorated metal panels.

It goes without saying that a complete record of the inspection should be made and preserved, and copies forwarded to the proper officer for his information and record or action.

Many Items to Watch

By H. B. Christianson
Assistant to Chief Engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Although a good tar and gravel roof needs little or no attention during the first five years after it is constructed, after that the inspection should be close and detailed, to determine whether recoating is necessary. This can be determined from the condition of the top layer of the felt. If it has lost its tar saturation, the roof should be recoated. It is important to look for bare spots on the roof where the gravel is scarce, since it is at these spots where the first trouble can be expected.

When leaks develop through tar and gravel roofing, it is sometimes difficult to locate the crack or hole through which the water finds entrance, because, with tight sheathing, the appearance of the leak on the underside of the roof does not always coincide with the point of entrance. In other words, the water does not always drip directly below the defect.

It is also quite important that the flashing be inspected carefully for cracks, for separations from the wall and for other imperfections, this being especially so when the roof is laid on concrete. Ceiling leaks may not betray defective flashing, but water allowed to enter and remain beneath the roofing, whether from this or other sources, will shorten its life considerably.

Built-up roofs of asphalt and felt, if laid during warm weather, require about the same kind of inspection as the built-up tar and gravel roof. However, if this type of roof has been laid in cold weather it is quite apt to wrinkle and blister during summer temperatures. If blisters are found they should be slit to remove any water they may contain, and allowed to dry.

Asphalt shingles generally continue to be serviceable until the exposed portions are worn or weathered to the point where they begin to break off. Nails in asphalt shingles are generally so well protected that they seldom cause trouble. Where appearance is important, such shingles may have to be replaced before they become unserviceable from a water-shedding standpoint, when the peeling off of the granules make the roof look shabby. During heavy wind storms, asphalt shingles may be forced upward until they are broken or so bent that they cannot be reseated satisfactorily, and thus produce leaks. However, modern shingles of this type, if laid correctly, seldom cause trouble of this kind.

Roll or sheet asphalt-felt roofing fastened to roof boards with nails requires close inspection to determine the condition of the nails, joints and surfaces so that needed repairs or replacement can be made before leaks develop. If the nail heads are failing, repairs can usually be made by renailing and by covering the nails and seams.

If heavy wrinkles appear, careful inspection sould be made to see whether cracks have developed or are about ready to do so. I have known some badly-wrinkled roofs of this kind to last many years without leaking. However, when a roof of this kind does begin to leak, about the only remedy is complete renewal.

Particular attention must be given to wooden shingles from the standpoint of fire hazard. When sparks from coal-burning locomotives are likely to fall on the roofing, it may have to be replaced while still in serviceable condition with respect to its ability to shed water. Failure generally occurs by reason of the cracking and curling of the shingles. It is seldom good policy to renail such roofs after they are badly weatherbeaten, because the shingles will then split and fall off. Transite, asbestos and other forms of rigid roofing usually fail through the rusting of the nails that secure them to the roof, although settlement or sagging of the roof will cause such roofs to crack and become dislodged. The important things to consider when inspecting metal roofs are the condition of the paint or other protective coatings, the nails or other anchorage and whether the metal has deteriorated from the underside.

Settlement at Bridge Abutments

What is the best way to prevent settlement of embankments next to concrete abutments or the timber bulkheads of bridges? Of overcoming continued settlement in existing embankments at these points?

Place Materials Carefully

By D. X. Greenberg
Assistant Engineer, Missouri Pacific, Wichita, Kansas

My experience with the settlement of the embankment at bridge ends causes me to believe that suitable sloping and tamping of the material as it is placed will largely, if not entirely, eliminate further settlement under traffic. In most trestles or bridges the bulkhead or backwall is placed in the embankment several feet above the natural surface of the ground. In other words, the bottom piece of backwall, whether constructed of timbers or reinforced concrete, does not rest on the natural ground. These bulkheads are designed for the slope of the embankment, either 1½:1 or 2:1, depending on the standard of each individual road. When filling around the ends of trestles, the usual custom is to fill inside the end bents then round off this portion with a quarter cone until the slopes outside and inside the backwall join together.

If this embankment is placed in uniform layers of one foot and tamped with a mechanical tamper, whether air or electric powered, a firm embankment can be established with only the minimum of settlement. In other words, if the new embankment is placed both outside and inside by tamping mechanically, and the slopes of embankments both outside and inside of backwalls are constructed to accepted standards, the approaches to the trestles will show little or no settlement for long periods of time unless erosion by heavy rains, or high water currents under the trestle, destroy the slopes so that the angle of repose is no longer maintained, and settlement is noted at the bridge ends.

To protect the embankment inside the backwalls under the trestle, where conditions justify, hand-placed rip-rap should be placed along the slope, and anchored below the natural surface at the toe of slope. This rip-rap may also be grouted if one desires to make it more permanent.

In old embankments where settlement occurs continuously, I would scarify the embankment 20 ft. or more outside of the backwall and do likewise to the embankment under the trestle inside of the backwall; then bring the slopes up to standard, tamp the embankment along the outside of backwalls with a mechanical tamper, and surface the track on new or cleaned ballast. This method has brought satisfactory results in numerous cases.

Depends on Cause

By Frederick W. Biltz
Assistant Chief Engineer, Reading, Philadelphia, Pa.

Settlement of embankments at abutments and bulkheads was found to be attributable generally to three causes, (1) the pushing out of the natural material at the toe of the embankment slope, (2) the presence of unstable material in the backfill, and (3) the rotting out of old timber falsework and forms. Where natural material is pushed out at the toe of the slope, remedial treatment would consist of one of the two accepted methods for correcting unstable sub-soil: the installation of French drains to lower the water table, or the driving of piles to prevent further movement.

When settlement results because of unstable material in the backfill and is caused simply by the compaction or reduction in volume, not much can be done except to raise the track as becomes necessary. If, however, settlement has resulted from impervious layers holding water, the pockets should be tapped by French drains in accordance with the treatment recommended in the first case.

When settlement occurs because of the rotting out of old timber falsework and forms, nothing much can be done except to restore the ballast and subgrade to the standard roadway section. The economical method would be to provide sufficient excess ballast and subgrade material to allow successive raises without requiring the use of a work train each time.

Finally, the old axiom that an ounce of prevention is worth a pound of cure is no more applicable anywhere than in railroad construction where good construction methods bring substantial returns in low maintenance costs. Preventive measures in these instances should consist of inspection of the sub-soil conditions, followed by the installation of sub-soil drainage where necessary, the selection of good filling material, adequate care in placing such material and religious removal of all temporary trestle timber and forms before backfilling is done.

Tries Grouting

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

Probably one of the best ways to prevent settlement at bridge ends is to provide adequate drainage and suitable filling material. If the filling material is not suitable, the best way to stabilize the embankment at this point is to grout it thoroughly by the pressure method, which will force the impounded water to the surface and give the embankment an opportunity to dry out. In addition the presence of the grout will exclude the entrance of additional water later, so that the material will remain dry and stable.

On the other hand, if the material of which the embankment is constructed is of better grade and more easily drained, it may be that the installation of a system of drainage will give the desired results without resort to grouting. If this can be done, I would prefer the drainage to the grouting in most cases, although there

are numerous cases where grouting is the only certain remedy. In other words, if water can be kept out of the embankment the grouting will be unnecessary.

Most of the trouble that is encountered by reason of settlement back of timber bulkheads results from weakness in the way the bulkheads were installed or because of decay in the timbers, whereby the earth is permitted to flow regardless of its moisture content. Such trouble can best be overcome by driving sufficient creosoted piles to form the needed support and by using second-hand treated timbers for the sheathing. When constructing such a timber bulkhead, room should be provided for the installation of drains and to allow for suitable pervious filling material.

A Troublesome Problem

By District Engineer

Settlement of embankments at the ends of bridges is one of the most troublesome of the many adverse conditions with which the maintenance forces are compelled to contend. It is found at the rear of backwalls of wooden trestles in relatively dry and well-drained terrain, as well as where the line crosses swampy ground. It is usually most troublesome and persistent, however, back of concrete backwalls. Excessive trouble is usually experienced when examples of the ancient U-abutments remain to plague both the bridgeman and the trackman.

In the first case, that behind wooden backwalls, there are several general causes, most of which can be corrected easily. One of the most common of these is not the fault of the bridge construction or of the character of the material used in the embankment, but results from failure of the track forces to keep the track to surface at the junction of the somewhat yielding earth fill and the more rigid bridge structure. Another is an insufficient ballast section immediately at the bridge end, usually brought about by too much tamping of the track in an effort to keep the track to correct elevation.

In the latter case the trouble may be more deeply seated in that the backwall does not extend far enough below the roadbed; or it may have been allowed to decay. Whichever is the reason, however, many bridge ends give trouble because the backwall does not provide adequate support for the embankment immediately adjacent to it.

Concrete headwalls are usually built integrally with the concrete abutments of which they form a part. Similar neglect to keep the track surfaced at the bridge ends can be found at these structures, in which event the same remedy should be applied, namely, more attention should be given to these spots than they receive habitually. On the other hand, most of the difficulties experienced at such bridges can be traced to inadequate drainage, unsuitable material employed for the fill, slipshod methods of making this portion of the fill or failure to remove falsework piles and timbers from the embankment.

Unsuitable materials include those clays that hold water tenaciously. Such materials placed back of concrete abutments will give trouble as long as they are allowed to remain in place, unless drastic action to remove the cause is undertaken. In such materials drainage, while it can be accomplished, is usually slow and uncertain. Until recently, the only alternative to drainage has been to remove the offending material and replace it with pervious material.

Within the last three or four years soil grouting has become a well-established practice for the stabilization of unstable soils and, on the railways, for stabilization of the roadbed. While this method has not yet been applied widely at bridge ends, when water is the principal cause of instability of the roadbed, it has been tried out sufficiently to indicate that excellent results are possible and that it will be worth while to extend the practice far beyond its present limits.

Where water is the primary cause of the adverse conditions, it is axiomatic that it should be kept away from the places where it causes these conditions. In the case under consideration drains should be laid back of the abutment and wing walls, and others should penetrate the embankment at suitable distances from the concrete surfaces. This, however, only takes care of the water that has already reached the seat of the trouble. It is always better to prevent than to remedy an undesirable situation. For this reason it is equally important that a system of drainage be installed that will cut off all water, except that which falls in the form of precipitation, this being especially desirable when a gradient descends toward the bridge.

Should Drains Be Marked?

When subdrainage with cross drains has been installed in a cut, is it worth while to mark the location of the cross drains? How should this be done? What other form of record, if any, is desirable?

Considers It Desirable

By R. A. Whiteford
Division Engineer, Chicago, Milwaukee, St. Paul & Pacific, Marion, Iowa

I consider it desirable to mark the location of subdrainage in cuts. The outlet of the main drain as well as the upper end of this drain should be marked with a white post, lettered in black to read "10 Tile Outlet" or "End 8 Tile Line," or some similar marking. This will show a new roadmaster or a new section foreman which cuts are tiled and will indicate to them the extent of the drainage installation. Furthermore, each cross drain in the cut could be marked with a metal plate on the nearest tie; the plate to be transferred to the new tie when the old tie is replaced. Markings on the rail are unsatisfactory, for rail renewals destroy all markings.

One of the reasons why I believe it to be important to mark cross drains is that, in case soft track develops in the cut, it may be readily determined whether the cross drains are functioning. Again, if it becomes necessary to dig one of them up, much labor will be saved if it is known where to dig.

Obviously, a permanent record of all tiled cuts and the limits of the tile should be kept on the right-of-way maps, while the files of the engineering department should also contain a permanent record showing all cross drains in relation to engineering survey stations. A sketch giving this information, and the size and type of the tile, should be made for each cut.

A Good Practice

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

That the foreman, the supervisor and other officers interested may have a precise record of all subdrainage within their own territories, it is a good practice to make a chart upon which is shown, with respect to permanent monuments, the location of all parallel cross and diagonal drains in the several territories.

Permanent records in chart form are far preferable to the practice of

marking the drains on the ground, especially so at a time when it is obligatory to use power ballast cleaners, graders and shapers on the roadbed. Such power equipment is quite apt to dislodge any markers that may be placed in or along the roadbed designating the locations of the drains.

Merits of Pipe Materials

What are the relative merits of cast iron, wrought iron and steel for underground water lines less than 4 in. in diameter? What precautions, if any, are desirable?

Same as for Larger Pipe

By G. E. Martin
Superintendent Water Service, Illinois Central, Chicago

In general, the class of pipe employed for underground water lines less than 4 in. in diameter should be the same as that used for larger-diameter pipe. Cast iron for underground cold water lines will generally give much longer service than steel or wrought iron, unless extra precautions are taken to prevent external corrosion. The application of a corrosion inhibitor with wrappings on wrought iron or steel underground pipe used for carrying cold water, does much to increase the life of the pipe. However, such applications also increase the first cost of the line beyond what it would be for a cast iron pipe line.

Cast iron pipe and fittings are available in diameters of 1¼, 1½, 2 and 3 in. in either precalked, threaded or bell-and-spigot types. This pipe is suited particularly for long, permanent, underground cold water lines, where conditions are such that severe vibrations or pipe strains are not set up.

Where the pipe line will be subjected to severe vibrations and strains, or when close fitting is required, the use of wrought iron or steel is more desirable. These pipes are generally lighter and easier to install than cast iron. Consequently they are better suited for temporary work or for service where the life of the pipe is of no particular concern.

Depends on Service

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

The most suitable material to be used will depend on the service that is to be required of the line and the soil conditions where it is to be laid. If this is in a railway yard which has holes and low spots filled with cinders, and which has been ballasted largely with cinders, the soil is quite likely to be sufficiently acid to cause serious corrosion of steel, with somewhat less corrosion of wrought iron and considerably less for cast iron. Under normal conditions, cast iron pipe is now available in sizes as small as 1¼ in.

Cinders are not the only source of corrosion, however, for there are some soils that are naturally corrosive to steel pipe. For this reason, whenever practicable, it is usually desirable to make use of cast iron pipe for underground lines. These small sizes are threaded and can be placed with no more difficulty than steel or wrought pipe. For sizes smaller than 1¼ in., wrought pipe, although more costly than steel, should be preferred because of its greater resistance to corrosion. Labor is such a large part of the cost of laying any small pipe, which must be several feet below the surface of the ground to assure frost protecton, that the less corrosive metal should be used.

Asphalt and other coating materials are available, which, if placed with care to coat the pipe effectively, especially at all joints, will add materially to the service life of even steel pipe, particularly if pains are taken to be sure that the coating is not scraped off in spots as the pipe is handled. The galvanizing of common steel pipe is always desirable as this adds to its life.

Where the soil is of clay or other dense material, much saving in labor can usually be accomplished by excavating holes only at intervals and either trenching to make an opening for the pipe or by using a pipe-pushing device to get the line through. Although such methods tend to destroy any coating on the pipe, they are generally justified by the saving in labor.

It is usually good policy to lay a pipe which is at least ½ in. larger than is actually required, so that when renewal becomes necessary because of corrosion after a period of years, a smaller size of copper pipe which, by reason of its smoothness, will transmit an equal quantity of water can be inserted in the original pipe.

Breakage of Operating Cables

What can be done to minimize the breakage of operating cables on sand spouts and coal chute aprons? What sizes and types of cable and sheaves are most satisfactory for each service? Why?

Not an Inherent Defect

By General Inspector of Buildings

Although it is true that many cables on coal chutes and sand spouts do give an undue amount of trouble from breakage, this trouble is not an inherent defect of the structures upon which they are used but, generally, can be traced to improper installation or to insufficient attention in the way of maintenance.

While I do not believe that wire rope is the best material that can be devised for this service, it seems to be the most easily available, the simplest to apply, and requires only a short time to replace in case of breakage. For these reasons, all of our coaling and sanding plants are equipped with wire rope, but I have often noted that on some divisions we have only a negligible amount of trouble from the breakage of these cables, while on others the reverse is true, with most plants as offenders.

I have found that one must give frequent attention to these cables if he expects anything like an approach toward immunity from cable breakage. The cables under discussion admittedly are subject to both severe service and severe exposure to deteriorating influences. At few places, even in enginehouses, are corrosive gases so highly concentrated as around coaling and sanding plants in busy terminals, and this is equally true of many such plants out on the line. These gases, combined with the moisture in the air, attack the individual wires of the cable actively, unless the latter are well protected, but even with the best protection that can be given, the gases still attack the wires.

Thorough and continuous lubrication of the cables will minimize this corrosive action; however, and this applies particularly in the case of the sand spouts, grains of sand become

embedded in the lubricant, whether oil or grease, and form an abrasive that adds its quota to the deteriorating activities against the wire ropes. Both the corrosive and abrasive actions can be minimized by careful attention, frequent cleaning and lubrication of the cables.

In general, the cables that are used for the operation of coal chutes and sand spouts should be run over sheaves of larger diameter than are usually installed and larger than are called for by tables of sheaves and heave sizes issued by manufacturers. I would be liberal in choosing this greater size for, so far as the life of the rope is concerned, this diameter can be considerably greater than what is usually considered to be the optimum for the cable under consideration. One who has not tried the increased diameter will be pleasantly surprised at the results.

Let me repeat, any facility or device that must undergo severe service should have a liberal factor of safety. In the particular case under consideration, not only will the service life of the cables be extended through this extra attention, but breakages will be avoided and the operation should be more satisfactory.

Prefers Chains

By W. C. Harmon
Supervisor of Bridges and Buildings, Southern Pacific, San Francisco, Cal.

It is difficult to suggest remedies for unsatisfactory performance without a definite knowledge of the circumstances surrounding the case. I do know, however, that all cables on coal chutes and sand spouts do not break prematurely or in an unreasonably short time. It can be said, however, that they represent a class of equipment that is subject to the most severe service conditions in any railway service, and that they rarely get the protection that they deserve.

Wire ropes are not made for this class of service, although they are used as the most suitable material available. It is my considered belief that chains of equal strength would prove to be more economical. The sulphurous gases and moisture-laden atmosphere which are so prevalent around coaling and sanding plants, especially at busy terminals, attack the fine steel wires of the cables to a greater extent than in any other equipment where cables are used. At sand spouts, condensation of moisture holds the sand, causing it to adhere to the cables, making an abrasive compound which contributes to the wear and tear the lines receive from other sources.

To counteract the effect of these corrosive gases and moisture I suggest that the cables for this service be made of special-alloy wire and that the cables for both coal chutes and sand spouts be protected with shields, whenever possible, to keep gases, sand and moisture away from them.

Again, the size of the sheaves over which the cables run has much to do with the life of the lines. Using a sheave of the correct size is obviously important, and one should be able to obtain information on the correct size to use from the tables put out by manufacturers. Cables in this service should be given more frequent and careful inspections, and should be kept well lubricated, as well as given such protection as may be practicable.

Do Tie Plates Affect Ties?

In what ways does the use of the tie plates affect the life of ties? Does the area, the eccentricity or the thickness of the plates make any difference? Why? How should they be fastened?

Double the Life of Ties

By C. C. Van Stratten
Roadmaster, Missouri Pacific, Jefferson City, Mo.

Tie plates of sufficient size and stiffness, suitably used, more than double the life of ties. This is proved by the fact that the softwood ties of today far more than outlive the hardwood ties of yesterday that were not so equipped. Tie plates increase the life of ties by maintaining a more even bearing on a larger surface of the tie and by maintaining gage, thus eliminating the necessity for gage-spiking the tie to death.

The most effective way of plating track is to plate every tie. In doing this the ties should be adzed so that the plates have an even bearing over the entire surface with which they are in contact. The adzed surface, if the adzing is done in the field, should be coated thoroughly with hot creosote, and the plate should be centered on the tie.

Plates should always be of sufficient thickness to withstand the traffic loads without bending. The bending of the plates under the rail will cause the rail to rock on its seat, thus causing variations in gage and excessive plate cutting or abrasion of the tie. Probably the most satisfactory results in spiking are obtained with one inside and one outside spike, staggered, as hold-down spikes on tangents and two additional spikes to each plate on curves.

Many Factors Involved

By H. R. Clarke
Chief Engineer, Burlington Lines, Chicago

The use of tie plates of suitable design and size has a definite effect on the life of ties, in that mechanical injury to the tie is reduced. The area covered (the size of the tie plate), the eccentricity and the thickness are all important factors. Perhaps size and thickness should be considered as a unit, since to some extent, at least, thickness necessarily varies with the size and must be increased as the tie plate is lengthened. The thickness of the plate should be such that the bending or flexing under load will be reduced to the minimum, and that the plate will not take a permanent set or bend.

The size of the plate necessary to afford protection to the tie will depend upon the weight of the rail, axle loads and the traffic density. It is desirable that the sheared width of the plate be as great as the size of the tie will permit. In other words, the plate should practically cover the width of the tie, as area added in width is more effective than the same area added in length.

The kind of tie, whether hardwood or softwood, is also a factor to be taken into consideration. Under the same traffic conditions, generally a larger plate is desirable on softwood ties than on those of hardwood. However, to attempt to handle plates of varying sizes might introduce complications which would be serious enough to overcome the advantages.

The eccentricity should be such that the plate will seat itself as nearly level or uniformly as possible. If the eccentricity is such that the plate sinks unduly in either direction, the stresses are increased substantially. In addition, there is difficulty in maintaining gage, which may be such as to require regaging. If this becomes necessary, the life of the tie will be definitely shortened.

Fastening the tie plate to the tie independently of the spikes holding the rail in position decreases, or may even eliminate, the relative movement between the tie and the plate and thus reduces proportionately the mechan-

ical action that causes wear on the tie. Various means for fastening the plates in this manner have been experimented with, including the fastening of the plate with bolts passing through the tie, with screw spikes having spring washers, with various types of patented and specially-designed spikes and with the ordinary cut spike. Doubtless, the plate fastened with bolts passing through the tie is most effective, but the cost is such as to render the practice prohibitive. All factors considered, it is probable that the fastening of the plate to the tie with the ordinary cut spike gives the largest economic return on the investment of the various types of fastenings.

Application Is Important

By C. D. Turley
Engineer of Ties and Treatment, Illinois Central, Chicago

Tie plates that have been designed and applied correctly reduce and retard wear of the ties, thus improving their effectiveness and increasing the service life of the ties. The plates and the method of their application are doubtless the most important items of track design affecting the destruction of ties as a result of mechanical action.

The maximum static wheel loads encountered, the compressive unit strength of the timber used for ties, the alinement of the track and the amount and speed of traffic are factors that determine the necessary bearing area, and hence the size, of tie plates. The plates should be of sufficient thickness to distribute the load as uniformly as possible over the entire bearing area.

Less eccentricity is required on tangents than on curves. For this reason, the most satisfactory arrangement is to use the maximum eccentricity from the viewpoint of assuring even cutting on tangents, so that maximum protection will be provided on curves. If the plates cut unevenly, high stresses are produced in the rail and optimum line and surface cannot be maintained.

Tests have shown that continued relative movement between a wood tie and a metal tie plate under traffic causes abrasion of the wood, hastens tie plate penetration and, eventually results in removal of the tie from the track. Satisfactory results have been obtained where the rails were held to gage by cut spikes and the plates were anchored to the ties with screw spikes applied in connection with double-coil washers.

Frost Action in Ballast

Is there any effective means of assuring uniform frost action in the ballast? If so, how can it be accomplished? Does this have any effect on the uniformity of frost action in the subgrade? If so, what? If not, why?

Drainage Necessary

By E. H. Barnhart
Division Engineer, Baltimore & Ohio, Garrett, Ind.

Generally speaking to insure uniform frost action in ballast it must be well drained and laid on a compacted subgrade of adequate slope to provide for a quick run-off of water reaching the subgrade through the ballast.

Ballast is usually classified in two general classes, hard ballast and soft ballast. The hard ballast materials are crushed rock, crushed slag or various combinations of these two materials, whereas soft ballast materials are gravel, chatts, soft slag, cinders and earth.

Frost action in hard ballast is best controlled by keeping the ballast free of dirt, cinders and debris that would tend to clog drainage through the ballast subgrade. Contour plays an important part in frost action in hard ballast, for a well-compacted subgrade with adequate slope will permit the water to drain through the voids of the ballast and run away from the sub-grade before it becomes saturated and subject to frost action.

In the soft ballast there is an entirely different condition, for a grade of soft ballast that will permit adequate drainage will insure less deteriorating frost action than a soft ballast with comparatively few voids. To cite an extreme case, a good washed gravel ballast on a compacted and well-drained subgrade will permit water to flow away from the underside of the ballast section and thus have little effect under freezing conditions. On the other hand, if the soft ballast is ordinary earth with a small percentage of voids, water will be absorbed by the ballast, and thus be held in the material near the section of the roadbed subject to freezing at higher temperatures, and the frost action will take place quicker and its effect on the track will be more pronounced.

Must Overcome Poor Drainage

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

The most effective way to insure uniform frost action in ballast is to provide adequate drainage of the ballast section. However, in many places poor drainage prevails and steps must be taken to overcome this condition. One of the best methods to adopt in order to overcome a bad drainage condition under the ballast section is to give the roadbed a sufficient blanket of pervious material as a sub-ballast. This material must be of sufficient depth to bring the subgrade below the frost line and thus keep the water in the subgrade from freezing.

An excellent material to use in providing this "blanket" is engine cinder, which is installed by raising the track to the desired height on cinder before applying the final ballast section. A good grade of gravel or coarse sand can be used with equal success to provide a protective blanket.

Equipment Installed—Class I railroads installed 26,825 new freight cars in service in the first eight months of 1946, according to the Association of American Railroads. These included 5,257 put in service in August, the largest number in any calendar month since May, 1942, when 6,805 new freight cars were placed in service. The number installed has fluctuated this year from a low of 2,350 in February to 3,650 in May. New freight cars put in service in the first eight months of 1945 came to a total of 27,740.

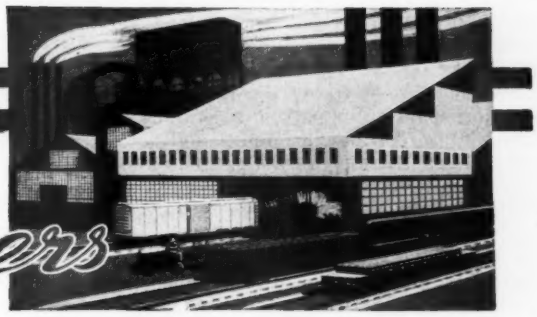
Those installed in the first eight months of this year included 10,522 hopper, including 2,772 covered hoppers; 3,793 gondolas, 621 refrigerator, 119 flat, 1,775 automobile box and 9,995 plain box freight cars.

The Class I roads also put 322 new locomotives in service in the first eight months this year, of which 73 were steam, and 249 were Diesel-electrics. New locomotives installed in the same period last year totalled 408, of which 59 were steam and 349 were Diesel-electrics.

Class I roads on September 1, had 50,169 new freight cars on order. On the same date last year, they had 38,249 on order. The former total included 13,042 hopper, including 2,114 covered hoppers; 4,273 gondolas; 1,099 flat; 16,841 plain box; 6,558 automobile, 8,056 refrigerator, and 300 freight cars of miscellaneous types.

Locomotives on order on September 1 totalled 556, compared with 512 on the same date in 1945.

PRODUCTS of Manufacturers



New Grease for Meco Lubricators

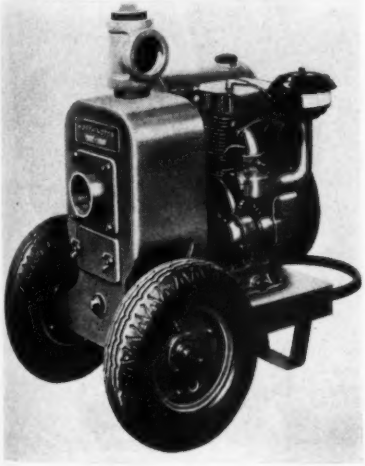
A NEW graphite type grease developed for use under extremely low temperature conditions primarily for service in rail lubricators manufactured by the Maintenance Equipment Company has been announced by The Texas Company, New York. Known as Grease 904-W the new product is said to be suitable for winter service in northern climates. It is claimed that it will give excellent performance at temperatures as low as —50 deg. F.

Blue Brute Portable Pump

WORTHINGTON Pump & Machinery Corporation, Harrison, N.J., has introduced a line of portable, self-priming, centrifugal pumps which are available in sizes of 1½ in. to 8 in. Known as Blue Brute pumps, the new units are said to meet the standard rating tables for this type of equipment, with liberal factors of safety in both capacity and power, and are recommended by the manufacturer for all types of railroad work where the use of pumps of this type is indicated. Under standard conditions, the 1½-in. model is capable to delivering 50 gal. of water per min., and the 8-in. model, 2100 gal. per min.

An important characteristic of the pumps is the self-priming feature, built in as a part of the hydraulic design, which is said to cause them to pick up water quickly and dependably, without the use of priming valves or recirculation. The pumps are made of corrosion and abrasion-resisting steel and are said to be rugged and light in weight. The 1½-in., 2-in., 3-in., and 4-in. sizes are equipped with air-cooled gasoline engines, while the 6-in. and 8-in. pumps have water-cooled engines, either gasoline or Diesel as desired.

It is said that the 1½-in. pump, which is base-mounted and equipped with a lifting handle, can be carried by one man. The larger sizes have pneumatic-tired wheel mountings.



One of the Larger Blue Brute Self-Priming Centrifugal Pumps

The Gradall Cleaning Out a Railroad Side Ditch

Gradall Earth Mover

THE Gradall Division of The Warner & Swasey Company, Cleveland, Ohio, has developed a new multi-purpose earth-moving machine known as the Gradall, which is intended to function, with the proper tool attachments, as an excavator, trenching machine, pipe layer, ditcher, grader, ripper, and snow remover. The Gradall can perhaps best be described as a mobile combination of interchangeable tools attached to the end of a telescopic boom. Briefly, it consists of a full-revolving rotating platform carrying a hydraulically-controlled boom, boom cradle, engine, pumps, and operator's cab—all mounted on the chassis of a six-wheel, pneumatic-tired, International truck.

The design of the telescopic boom is an important factor in the high performance claimed for this machine because it is said to permit all of the various movements afforded by a man's hand and forearm. The tools are pulled into the work instead of being pushed—a feature that is said to make precise and finished work possible, including square-sided excavations, clean-cut ditches, chamfers and contours, without costly hand labor.

Of all-welded construction, the boom includes an inner boom that travels on free-running rollers within an outer boom, each having three reinforced tubular members which give rigidity for heavy-duty work. The boom may be extended 12 ft. to a total length of 24 ft. from the pivoting point, and then retracted. It can be raised to a 22-deg. angle, or low-

ered to a position 44 deg. below horizontal. The boom is so mounted in a cradle-like double-ring assembly that it may be tilted 45 deg. each way from the horizontal to impart a twisting action to a tool attached to its end. Also the tool itself can be made to operate in a vertical arc of 116 deg. Owing to these various movements and the operating principle employed, the Gradall is said to be capable of exceptional manipulation for working around poles and in cramped quarters, and to be capable of working in places where overhead clearances are restricted.

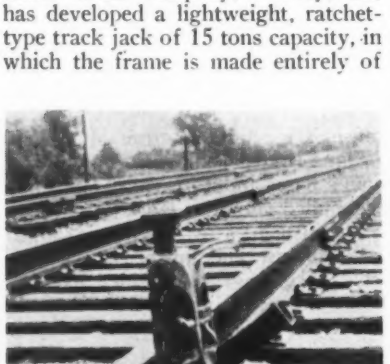
All the movements of the Gradall machine, other than the truck movements, are controlled hydraulically from the operator's cab by means of two pedals and three levers. Power is supplied by an International Harvester U-9 gasoline engine geared to four pumps which furnish the hydraulic system with an operating pressure of 1000 p.s.i. The operator's cab is located alongside the boom where the operator has a clear view of the working tool through full-vision, shatterproof windows.

The tool attachments are said to be easily interchangeable by the loosening of the nuts on two hinge bolts on the end of the boom and the removal of a pin at the end of the control rod.

For transporting the machine over highways, the boom is retracted and the tool end is swung to rest on a support immediately behind the truck cab. In this condition it is 8 ft. wide, 27 ft. 2 in. long and 10 ft. 5 in. high.

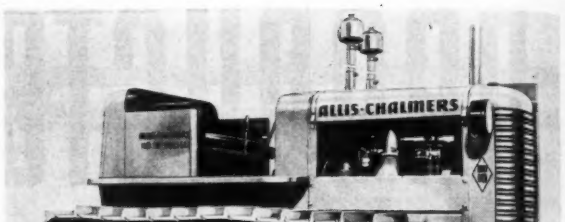
Aluminum Track Jack

THE Buda Company, Harvey, Ill., has developed a lightweight, ratchet-type track jack of 15 tons capacity, in which the frame is made entirely of cast aluminum alloy. By using aluminum, the weight of the jack is reduced to 38 lb., a saving, it is said, of 23 lb. compared with a similar jack with a malleable iron frame.



The Buda Model 135A Track Jack

The new jack is known as Model 135A, and is made in the same size and capacity as the Buda Model 715 track jack. It has an overall height, when closed, of 21⅜ in. and a rise of 13 in. Several of the jacks have been tested in actual service for a period of several months and the aluminum alloy frames are reported to be standing up as well or better than those of malleable iron. In laboratory compression tests, the aluminum-alloy jack is said to have performed as well as the malleable iron design.



Allis-Chalmers Improved HD-10 Tractor

Improved Tractor

SEVERAL recent changes in the Model HD-10 track-type tractor produced by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., are said to have greatly improved the performance of this Diesel-powered unit. The improvements include changes in the construction and design of the unit, particularly in the tracks and in the truck-wheel mechanism. Certain characteristics of the former machine, such as six speeds forward and two in reverse, and 86.6 hp. at the draw bar, are retained.

The length of the tracks has been increased to 8 ft. in the new unit by introducing two additional shoes per track and by using a longer, heavier truck frame incorporating additional rollers. This arrangement, together with an extra-heavy front spring, are said to make the HD-10 suitable for use with front-end-mounted or engine-mounted equipment.

Another important feature of the improved tractor is the new track-release mechanism, embodying a bell-crank spring assembly, which is designed to absorb the excess pressures developing when the tracks become clogged with dirt. With this mechanism, it is claimed that excessive strains are reduced and damaging shocks are eliminated.

The truck wheels of the HD-10 are now grease packed at the factory and have a "positive seal", grease-retaining feature that is said to permit 1,000 hours of operation without additional attention. Another innovation is the use of tapered roller bearings in the truck wheels for increased life.

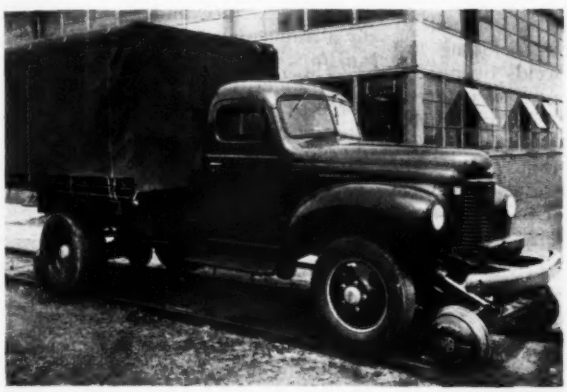
Walk-up Safety Steel Climbers

THE Austin Supply Company, Philadelphia, Pa., has developed a device, known as the Walk-Up Safety Climber, for use by workman when climbing perpendicular flanged-steel structural shapes. The device is made in pairs for wear under the work-

Wearing Walk-Up Safety Steel Climbers, the Workman Reaches Places Accessible Only With Ladders, Slings or Scaffolds

man's shoes, and is attached to the feet with straps. It is of welded construction with a tread shaped to fit the bottom of the shoe, a heel plate to insure its positive and exact positioning, and a metal extension at the toe end, to which are attached two hard-rubber gripping spurs, the design of which is said to give a full 3-in. purchase on each side of the beam. The toe extension slopes upward to permit the workman to walk without difficulty on flat surfaces.

It is claimed that the climbers are of positive safety design, that they will firmly grip metal surfaces with no possible chance of slippage, even on wet surfaces, and that the wearer, with feet parallel to the ground in a normal standing position, is relaxed and can do his work with ease and efficiency.



The Auto-Railer 1½-Ton Maintenance of Way Truck

Evans Auto-Railers

THE Evans Products Company, Detroit, Mich., has announced that its Auto-Railer vehicles will be produced in four models at its new Detroit plant near Plymouth, Mich. The Auto-Railer is a pneumatic-tired dual-purpose "on-and-off the track" vehicle equipped with retractable, flanged, steel pilot wheels which serve as guides when the vehicle is operated on railroad track. For highway operation the pilot wheels are retracted by a hydraulic mechanism operated by controls located near the steering wheel.

The four models of the Auto-Railer include a 1½-ton maintenance of way truck equipped with a canopy body; a deluxe officials' inspection car designed to provide the comfort and all-around visibility of a station wagon; a 1½-ton chassis with provision for the installation of various types of maintenance of way equipment; and a ¾-ton panel body truck. The 1½-ton maintenance of way truck is fitted with seats for 12 men in addition to the driver and two men in the front seat. The officials' inspection car, with a body of all-steel construction, is designed to seat six men in addition to the driver. The seats used, which are made by a leading supplier of automobile station-wagon seats, are arranged in such a manner as to provide ample leg room as well as interior space for luggage. Sufficient space is also provided for a small Pullman table or typewriter desk. The two rear seats are mounted on independent swivels so they can be adjusted to face forward or to the rear.

There are five doors in the inspection car, including a door at each side of the driver's seat, a door on the right side of the second row of seats and two rear doors. If desired, the rear doors can be locked in the open position so that an uninterrupted view of the track from the rear seats may be had. The car has a total of nine windows, with the tops of the side windows somewhat higher than in ordinary passenger cars to provide greater vision for overhead inspection. The entire car is insulated to provide maximum comfort during cold weather. The insulation in the floor also serves to reduce noise, thereby permitting conversation in normal speaking tones. Two interior roof lights provide ample illumination.

A variety of maintenance of way equipment may be installed on the 1½-ton Auto-Railer chassis. Such equipment includes cranes and power shovels, dump truck bodies, blade plows, pressure grouters, air compressors, salt spreaders, weed burners, generators and welders, and lineman's tower bodies. This chassis will be made available without the special equipment, with the idea that the purchasing railroad will secure and install whatever special types of equipment are desired.

The ¾-ton panel body truck is offered for use in all cases where it is necessary to carry men and equipment under more cover than that afforded by the maintenance of way truck. Thus, it is adaptable for transporting signal department crews and their tools, engineering parties, fire-patrol parties, and electric generators. Also the car can be used to carry tools, equipment, supplies, food and water to working crews located away from highways and towns. It is pointed out that expensive equipment carried in the truck can be locked up, safe from theft and damage. The panel body truck is said to be capable of carrying eight men in comfort, with additional comfort obtainable by the installation of temporary benches. Still another possible application of the panel body truck is its use as an emergency ambulance to transport injured persons from train wrecks occurring away from highways or roads.

Prior to the war Auto-Railers were custom built for installation on many makes and types of vehicles to serve a variety of different railroad and industrial uses. During the war production was standardized to make possible volume delivery to the armed forces, and this experience led the company to decide on the production of two basic models, the official inspection car and the maintenance of way truck, from which the other two models are adapted.

A variety of improvements have

The Auto-Trailer Officials' Inspection Car Has a Body of All-Steel Construction

The Panel Body Auto-Railer Operating on Track

been incorporated in the new Auto-Railers as the result of war-gained experience. These include reduction in over-all weight, a simplified hydraulic retraction mechanism, improved weight distribution, the use of stabilizer springs for rail operation, and safety lights in the driver's compartment to indicate the position of the pilot wheels at all times. An optional reverse gear providing equal speeds forward or reverse has been incorporated for use when the machines are operated on the track.

The rubber tires used on the Auto-Railers are specially designed to provide maximum traction on both dry and wet or slippery rails. The coefficient of friction of these tires on rails is said to be about 3½ times that of conventional steel railroad wheels on rails. During rail operation about 50 per cent of the vehicle load is carried by the rubber tires, and all driving and braking is through these tires, the flanged steel pilot wheels serving only as guides. The Auto-Railers are capable of speeds up to 60 m.p.h. on both railroad track and highways. It is said that they can be placed on the track in 30 seconds and run off the track without a stop at any road crossing.

All Position Electrode

AIR Reduction Sales Company, New York, announces a general purpose, extrusion-coated, mild-steel electrode, No. 87, which is said to operate exceedingly well on direct-current, straight or reverse polarity, or on alternating current, and to produce a weld metal of high mechanical properties. Especially recommended for single or multiple-pass welding on plates or sections where the fit-up is poor or the work is rusty or dirty, the new electrode is said to give excellent results in all positions. Some specific uses mentioned by the manufacturer include the welding of storage tanks, steel structures, sections of hoppers and boxcars, and general maintenance and repair work in railroad shops and foundries.

The new electrode is claimed to have many advantages including the making of excellent welds over wide current ranges for any diameter, a high deposition rate, similar performance characteristics when used with either direct current or alternating current, and an arc action which enables the less skilled operator to produce excellent results, even when working on the lighter gage metals.

Improved Tamping Machine

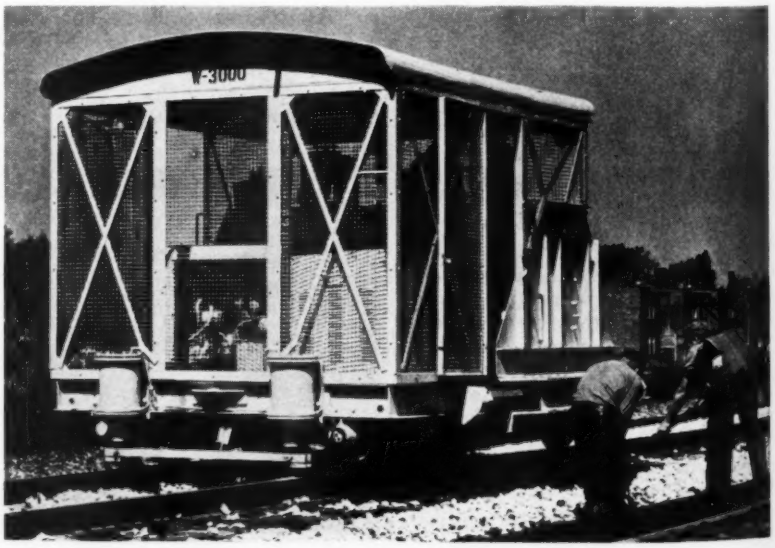
THE Power Ballaster Company, Chicago, has improved the design of its track-mounted, power-tamping machine, known as the Power Ballaster, so that it now tamps both sides of a single tie simultaneously, rather than tamping one side of two adjacent ties as done by the earlier model. The improved unit is said to produce uniform work in any kind of ballast regardless of the amount of the raise.

The unit consists of a heavy flanged-wheel carriage on which a 65-hp. gasoline engine and an operator's cab are mounted. A heavy crosshead member, extending the full length of the ties, is mounted transversely beneath the floor of the carriage. Along each side of the crosshead is a series of tamping shoes to each of which a number of tamping bars are attached by bolted connections.

In tamping, the crosshead is lifted by the engine and then released, falling by its own weight for the tamping blow. As the tamping bars fall into the ballast crib on each side of the tie, they drive downward into the crib for a short distance and then, activated by a connecting link-and-toggle mechanism, they are guided toward each other under the tie. It is said that the force of the blow is increased as the slanting movement is begun, and that through this action more uniform compaction of the ballast under the tie is attained.

In operation, the Power Ballaster follows close behind the raising gang, tamping each tie to a full bearing. The operator moves the machine from tie to tie with the aid of a travel clutch, and positions the crosshead over each tie by looking through a hole in the floor of the cab. The machine is then held in place while the crosshead is allowed to drop for the proper number of blows, after which the unit is moved to the next tie.

The operator, a foreman, and four laborers, the latter forking in additional ballast as required, are em-



Tamping Track with the Improved Power Ballaster

The Tamping Bars, Attached to the Crosshead, Fall into the Ballast Crib along Each Side of the Tie. The Tamping Bars Then Slant Toward Each Other Under the Tie to Complete the Tamping Blow

ployed where the Power Ballaster is used. With experience, the operator can develop excellent judgment as to the proper number of blows required at each tie by the "feel" of the machine as the blow is struck. However, this should be checked frequently by the foreman in charge of tamping to insure that the proper number of blows is being delivered.

The 65-hp. engine is used both for performing the tamping operation and for propelling the machine along the track. Speeds up to 30 m.p.h. may be obtained in moving to and from the point of work. The ballaster is equipped with a power-operated set-off, by means of which, it is said, it can be removed from the track in about five minutes.

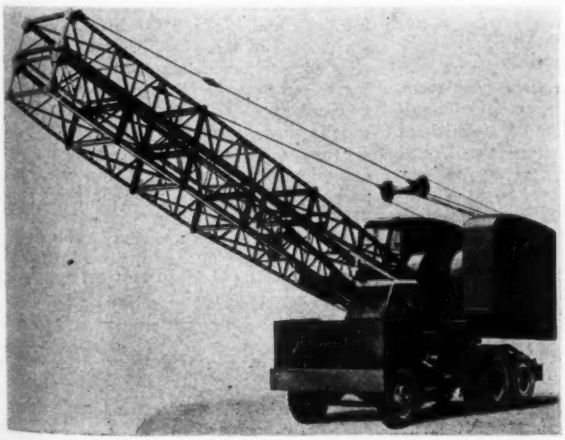
The Power Ballaster is recommended by the manufacturer for use in stone, slag, gravel or cinder ballast, and tamping bars are available for use with each material. The tamping bars are made of chrome-nickel steel, heat-treated for resistance to wear.

One of the machines has been in use on the New York Central System, Lines West of Buffalo, during recent months. This machine, working in stone ballast, is equipped with 24 of the tamping bars, four being located outside each rail, and two on the inside, along each side of the tie. With this arrangement, tamping is done for 18 in. outside the rail and 8 in. inside the rail, and, it is said, with uniform compaction throughout, even under the base of the rail. The track involved has been given an average raise of 3 in., with four to six blows per tie. Working at the rate of four to six ties per minute and, depending on the number of traffic interruptions, the machine has tamped from ½ to ¾ mile of track daily in two shifts.

Truck-Mounted Crane

THE Koehring Company, Milwaukee, Wis., has introduced a new truck crane, known as Model 304, which is said to be capable of lifting 40,000 lb. at a 12-ft. radius, with the aid of outriggers, and 15,800 lb. without outriggers. The new crane, which is adaptable for use as a shovel, pull-shovel, and dragline, embodies the same base machine that is used in the Koehring 304 crawler model, but has a greater lifting capacity, said to result from the increased stability gained by the truck mounting.

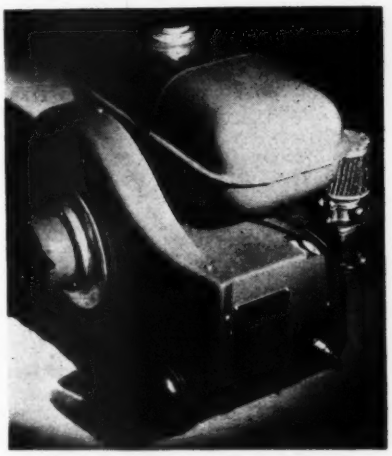
The unit features a hinged boom which may be folded quickly into the travel position. Booms are available in lengths up to 110 ft., and jib boom extensions are offered in 15-ft. and 30-ft. sizes. The truck is designed to move at traffic speeds, reducing the amount of unproductive time lost in moving from job to job. It is claimed that this unit may be taken to any location where trucks can be operated.



The Koehring 304 Truck-Mounted Crane with the Boom in Travel Position

Portable Gasoline Engine

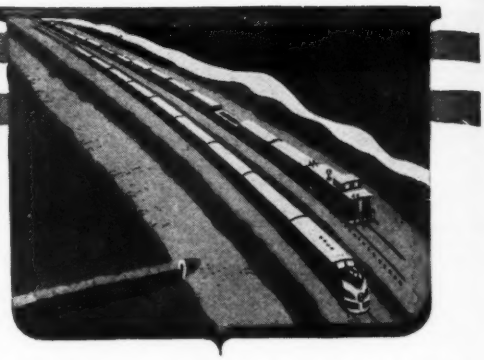
A NEW portable gasoline engine, "The Busy Bee," has been introduced by the Gladden Products Corporation, Glendale, Cal., which is recommended by the manufacturer for use with power saws, pumps, generators, mixers, agitators, sprayers and many other types of equipment. The engine, known as Model AB-3, is rated at 5 hp., but it is said that 6 hp. are developed at 3250 r.p.m. The new unit is a single-cylinder, 4-cycle, air-cooled engine with a 2¾-in. bore, a 3-in. stroke, and a 1-in. power take off shaft. Head, crankcase and piston are all of aluminum for lighter weight and improved cooling characteristics, and the engine, which weighs 75 lb., is said to be the lightest in its horsepower class. Very compact, it occupies a space 15 in. high by 18 in. wide by 15 7/16 in. long.



The Busy Bee Portable Gasoline Engine

Additional features include pressure lubrication to all bearings, hardened bearing surfaces and a horizontal, easily detachable cylinder. The engine is said to have a flat torque curve, insuring satisfactory performance under heavy loads.

NEWS of the Month



August Operating Revenues 6.7 Per Cent Under 1945

From preliminary reports of 86 Class I railroads representing 80.8 per cent of total operating revenues, the Association of American Railroads has estimated that the August gross amounted to $569,333,282, a decrease of 6.7 per cent below the $610,410,064 reported for the same 1945 month. Estimated August freight revenues were $439,171,645, practically the same as August, 1945's $439,028,343, while estimated passenger revenues were $91,041,249, compared with $126,010,538.

Eight-Months Ton-Miles

The volume of freight traffic handled by Class I railroads in the first eight months of 1946 was approximately 21.6 per cent under 1945 and about 23.7 per cent less than in the corresponding period in 1944, according to a preliminary estimate by the Association of American Railroads. Freight traffic in the first eight months of 1946 totaled approximately 378 billion ton-miles compared with 482 billion ton-miles in the same period last year. Compared with two years ago, the decrease was 118 billion ton-miles.

August traffic amounted to about 54 billion ton-miles, a decrease of five per cent compared with August, 1945. The amount of traffic handled by the Class I railroads in August this year, however, was 88 per cent greater than the volume carried in August, 1939.

Tie Renewals Down 8.4 Per Cent

Reflecting the difficulties that continued to surround the procurement of crossties, and the extreme shortage of labor with which the railways were contending during most of the year, only 43 Class I roads in the United States and one in Canada inserted more ties per mile of maintained track in 1945 than they did in 1944, while 83 roads in the two countries inserted fewer ties, three inserted the same number during each of the two years, and one road inserted no ties during 1945.

As a net result of these operations, the Class I roads in the United States inserted 43,731,792 new wooden crossties, 180,091 second hand ties and 330 ties other than wood, making a grand total of 43,912,213 ties of all classes inserted in 1945. This represents a decrease of 4,142,589 ties, or 8.4 per cent. The three Canadian roads reporting inserted 7,544,198 new wooden crossties in 1945, compared with 7,638,324 for the three roads reporting for 1944, a decrease of 94,126 crossties.

The number of ties renewed per mile of track maintained by individual roads did not differ widely from the number replaced in 1944. This is attested by the fact that the average for all of the roads in the United States was only 12 less in 1945 than in 1944, and seven less than the five-year average ending in 1945.

Of similar interest are the comparisons by regions, these being for the New England region, from 84 to 72; the Great Lakes region, from 131 to 107; the Central Eastern region, from 127 to 115; the Pocahontas region, from 90 to 89; the Southern region, from 187 to 186; the Northwestern region, from 144 to 136; the Central Western region, from 139 to 136; and the Southwestern region, from 169 to 124. For the United States as a whole the comparison is from 144 to 132.

The five-year average by regions was: New England 85; Great Lakes, 120; Central Eastern, 121; Pocahontas, 87; Southern, 184; Northwestern, 143; Central Western, 134, and the Southwestern, 162. For the United States as a whole the five-year average was 139.

In 1945 treated ties were used exclusively on 66 roads, compared with 71 roads in 1944, and only two roads did not use any treated ties in 1945. On 40 other roads more than [illegible] per cent of the ties inserted for replacement were given preservative treatment; on eight roads the percentage of treated ties ranged from 60 to 80 per cent; on six roads the range was from 40 to 60 per cent; while on four roads 20 to 40 per cent of treated ties were applied; and on only five roads was the percentage of treated ties less than 20.

British Railwaymen to Study U. S. Maintenance Practices

A party of British railway engineers, headed by W. K. Wallace, chief civil engineer of the London, Midland & Scottish, at London, England, is visiting the United States this fall to study recent railway engineering and maintenance practices developed in this country. Accompanying Mr. Wallace are H. B. Everard, engineer (permanent way); R. L. McIlmoyle, engineer (structures); and Dr. J. L. Martin, architect.

The party attended the concurrent conventions of the Roadmasters and Maintenance of Way Association and the American Railway Bridge & Building Association, which was held in Chicago on September 17, 18 and 19.

Mr. Wallace last visited this country in 1938, when he made a similar tour during which he addressed the members of the Roadmasters and Maintenance of Way Association at their 53rd annual convention in September of that year.

Crosstie Purchases

Crosstie purchases during June slipped slightly below the March high and aggregated $7,568,000, or a drop of 5 per cent. They surpass the $5,786,000 spent for ties during January by 31 per cent, top the February total by 24 per cent, exceed the $7,415,000 spent for crossties during April by 2 per cent, but dropped 4 per cent under the May expenditure which aggregated $7,888,000. Moreover June, 1946, purchases top the June, 1945, tie purchases by 23 per cent, approximate similar purchases during the comparable month of 1944, top crosstie purchases during the same month of 1943 by 11 per cent, 1942 by 23 per cent and are 88 per cent greater than the $4,025,000 spent for this material during June, 1941.

Expenditures for crossties during the first six months of this year amounted to $42,678,000, a gain of 22 per cent over the comparable period last year; they approximate the $42,684,000 spent for similar material during the corresponding period of 1944, exceed 1943 tie purchases by 21 per cent, top similar purchases during the first half of 1942 by more than 24 per cent and are 81 per cent greater than the $23,614,000 expended for this purpose during the same six months of 1941.

First Half Purchases Top $732 Millions

Class I railroads spent $124,108,000 during June and $732,148,000 during the first six months of this year for materials, supplies and fuel, excluding equipment, according to estimates based upon special reports received from 78 individual roads. Railway buying during June was greater than for any other month this year with the exception of January and March. June purchases dropped 6 per cent below the $132,107,000 spent during January; however, they exceed the February expenditure by 11 per cent, but sag 6 per cent under the March total, top the $116,531,000 spent for similar material, supplies and fuel during April by 7 per cent and are fully 8 per cent greater than May purchases which aggregated $114,911,000.

June purchases dropped 6 per cent below the $131,815,000 spent for the same purpose during the comparable month of 1945, 10

per cent less than spent during the sixth month of 1944, but top the $110,352,000 spent for similar material and supplies during the corresponding month of 1943 by 12 per cent, are 16 per cent greater than the June, 1942, total and are approximately 30 per cent greater than the $95,814,000 expended for this purpose during the same month of pre-war 1941.

Expenditures for materials, supplies and fuel during the first six months of 1946 sagged 5 per cent below similar purchases during the comparable period of 1945; they are 10 per cent less than the $810,848,000 spent for this purpose during the same period of 1944, but are 12 per cent greater than similar purchases during the same six months of 1943, top 1942 expenditures by 11 per cent and are 38 per cent more than the $528,914,000 spent for the same purpose during the first half of 1941.

M. W. Clement to Receive Vermilye Medal

Selection of M. W. Clement, president of the Pennsylvania, to receive the Vermilye Medal of the Franklin Institute of Philadelphia, Pa., was announced on September 3 by the secretary and director of the institute, Dr. Henry Butler Allen.

The Vermilye Medal is presented every two years in recognition of outstanding contributions in the field of industrial management. Mr. Clement receives the award for his "conspicuous accomplishments . . . in a time when the organization and facilities under his administration were taxed to the utmost by the war burden." It will be presented to him by Charles S. Redding, president of the Franklin Institute, in ceremonies to be held in Franklin hall, Philadelphia, on October 4.

Rail Deliveries Lower

Rail purchases during June dropped below the year's high which was registered during April and totaled $4,029,000, a drop of 30 per cent below the $5,730,000 spent for this material during the fourth month of 1946. It is also 17 per cent less than January rail purchases; however, it tops the seven-year low reached during February by 404 per cent, exceeds the $3,086,000 spent for similar material during March by 30 per cent, but dropped 15 per cent below May purchases which aggregated $4,751,000. Moreover, June rail purchases are 39 per cent less than the June, 1945, total, 38 per cent less than the $6,508,000 spent for rail during June, 1944, 12 per cent under purchases during the comparable month of 1943, 31 per cent less than 1942 and 17 per cent less than the $4,861,000 spent for rail during the sixth month of 1941.

Rail purchases during the first six months of 1946 aggregate $23,225,000, the lowest level reached since 1938. They were 35 per cent less than the $35,659,000 spent for similar material during the comparable months last year, 41 per cent below rail purchases during the same six months of 1944, 15 per cent less than 1943, 20 per cent under rail purchases during the corresponding period of 1942 and 22 per cent less than the $29,805,000 expended for similar material during the comparable six months of 1941.

Changes in Railway Personnel

General

Thomas C. Macnabb, general superintendent of the New Brunswick district of the Canadian Pacific, with headquarters at St. John, N. B., and an engineer by training and experience, has retired.

Frank S. Austin, general purchasing agent for the New York Central System, with headquarters at New York, and an engineer by training and experience, has been appointed manager of purchases and stores, with the same headquarters.

Frank R. Layng, chief engineer of the Bessemer & Lake Erie, at Greenville, Pa., has been appointed vice president and chief engineer, with the same headquarters. Mr. Layng was born on September 9, 1878, at Salem, Ohio, and was educated

Frank R. Layng

at the University of Pennsylvania. He entered railway service on October 1, 1897, as a rodman on the Buffalo & Alleghany division of the Pennsylvania and was advanced to draftsman on December 1, 1902. He was further advanced to engineer of bridges three years later and then to engineer of track on May 1, 1906. Mr. Layng retained this position until the latter part of 1926, when he was promoted to assistant chief engineer. In 1931 he was promoted to chief engineer, the position he held at the time of his recent appointment.

Curtis A. McRee, superintendent on the Seaboard Air Line, at Raleigh, N. C., and an engineer by training and experience, has been appointed assistant general manager, with headquarters at Savannah, Ga.

Mr. McRee was born on January 22, 1898, at Watkinsville, Ga., and was graduated from the Georgia Institute of Technology, receiving a B.S. degree in civil engineering in 1922. Mr. McRee entered railroad service on January 8, 1923, as an engineering inspector in the office of the chief engineer of the Seaboard Air Line at Norfolk, Va. From February 14, 1924, to December 15, 1933, he served in various capacities in the maintenance of way and structures department, including such positions as assistant to the division engineer, assistant division engineer, assistant roadmaster, division engineer, and roadmaster, becoming trainmaster on the latter date. He was appointed assistant superintendent of the North Carolina division on May 15, 1942, and advanced to the post of superintendent of the Virginia division, with headquarters at Raleigh, N. C., in 1943, leaving that post in November of the same year to enter the United States Army. Mr. McRee was placed in command of the 722nd Railway Operating Battalion, and had attained the rank of colonel when he was honorably discharged in May of this year. He returned immediately to his former post at Raleigh, which he held until the time of his promotion.

John T. Moon, superintendent on the Southern, at Greensboro, N. C., and formerly roadmaster at Hattiesburg, Miss., has been appointed general manager, Western Lines, with headquarters at Cincinnati, Ohio, succeeding **Fred W. Okie,** who has resigned to become president of the Union Railroad Company, with headquarters at Pittsburgh, Pa.

Engineering

R. C. Heckel, assistant engineer on the New York Central, at Cincinnati, Ohio, has been transferred to Mattoon, Ill.

B. J. Ornburn, assistant bridge engineer on the Northern Pacific, at Seattle, Wash., has been appointed assistant bridge engineer on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago.

C. G. Davis, engineer-roadmaster on the Kansas City Southern, has been appointed division engineer on the Milwaukee-Kansas City Southern Joint Agency, with headquarters at Kansas City, Mo.

G. S. Turner, division engineer on the Denver & Rio Grande Western, at Pueblo, Colo., has been appointed chief engineer on the Denver & Salt Lake, with headquarters at Denver, Colo.

Hector MacNeil, division engineer on the St. Lawrence division of the Canadian National, has been appointed assistant engineer of construction, with headquarters at Toronto, Ont.

F. W. Campbell, assistant division engineer on the Canadian National, has been appointed division engineer, with headquarters as before at Belleville, Ont., and jurisdiction over the Belleville division.

L. W. Moss, formerly assistant engineer on the Illinois division of the Big Four, with headquarters at Mattoon, Ill., and recently returned from military service, has been appointed assistant division engineer of the Western division of the New York Central, with headquarters at Chicago, where he succeeds **J. F. McCook,** who has been promoted to division engi-

neer on the Michigan Central with headquarters at Detroit, Mich., succeeding **John Evans,** who has been appointed special engineer, with the same headquarters.

F. A. Felstead, roadmaster on the Canadian Pacific, at Irricana, Alta., has been appointed division engineer, with headquarters at Winnipeg, Man., succeeding **C. K. Holden,** retired.

George E. Smith, assistant engineer on the Canadian National, has been named engineer, right of way, of the Atlantic region of the C.N.R., with headquarters at Moncton, N.B., succeeding **Robert H. Emmerson,** who retired on September 1, after 46 years' service.

J. D. Sutphen, formerly engineer maintenance of way of the Danville & Western, and the High Point, Randleman, Asheboro & Southern (parts of the Southern System), has been appointed office engineer of the Southern, Subsidiary Lines, with headquarters as before at Charlotte, N.C.

J. P. Zearley, supervisor of track on the Pennsylvania, at New Brunswick, N.J., has been promoted to assistant division engineer on the Maryland division, with headquarters at Baltimore, Md., succeeding **A. W. Miller,** resigned.

G. L. Plow, division engineer of the Ottawa division of the Canadian National, with headquarters at Ottawa, Ont., has been transferred to the Levis division at Levis, Que. **G. N. C. Allen,** assistant division engineer, St. Lawrence division, Montreal, Que., has been named to succeed Mr. Plow as division engineer at Ottawa.

Bridge and Building

V. E. Howard, bridge and building superintendent on the Canadian National, with headquarters at Jasper, Alta., has retired after 35 years of service.

K. G. Nilsson, roadmaster on the Canadian National at Mirror, Alta., has been promoted to bridge and building master, with headquarters at Calgary, Alta., succeeding **A. Crawford,** retired.

Track

Joseph B. Oatman, supervisor of road on the Baltimore & Ohio, with headquarters at Buffalo, N.Y., has retired.

W. H. Gibson, roadmaster on the Canadian Pacific, at McAdam, N.B., has been transferred to the Galt subdivision, with headquarters at London, Ont.

S. P. Jones, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Pratt, Kan., has retired after 32 years of service.

I. H. Weaver has been appointed assistant supervisor of track on the northern subdivision of the Cincinnati division of the Chesapeake & Ohio, with headquarters at Chillicothe, Ohio, succeeding **H. G. Whittet, Jr.,** transferred.

H. R. Leftwich, assistant roadmaster on the Scioto division of the Norfolk & Western, at Chillicothe, Ohio, has been promoted to roadmaster, with the same headquarters, succeeding **R. J. Royer,** retired. **W. O. Tracy, Jr.,** assistant roadmaster on the Scioto division at Portsmouth, Ohio, has been promoted to roadmaster on the Pocahontas division, with headquarters at Iaeger, W. Va., succeeding **D. K. Wickham,** whose death is reported elsewhere in these columns.

H. T. Griffin has been appointed acting roadmaster on the Atlantic Coast Line, with headquarters at Fitzgerald, Ga., succeeding **R. F. Hammond,** who has been transferred to Tifton, Ga.

R. L. Guy, roadmaster on the Atlantic Coast Line, at Thomasville, Ga., has been transferred to Folkston, Ga., replacing **V. A. Hodges,** retired. **J. Y. Chambers** has been appointed acting roadmaster, with headquarters at Thomasville, succeeding Mr. Guy.

Leo Donovan, recently released from the armed forces, has returned to the Illinois Central to resume his position as supervisor of track at Litchfield, Ill., replacing **C. E. Belangee,** acting supervisor of track, who returns to his position as section foreman at Litchfield.

W. E. Griffiths, division engineer on the Canadian National, has been appointed general maintenance inspector in the office of the chief engineer, with headquarters as before at Montreal, Que., succeeding **W. H. McGaan,** retired.

E. Westlund has been appointed acting roadmaster on the Canadian National, with headquarters at Mirror, Alta., succeeding **K. G. Nilsson,** whose promotion to bridge and building master at Calgary, Alta., is reported elsewhere in these columns.

O. M. Olson, assistant roadmaster on the Chicago & North Western, at Mayfair, Ill., has been promoted to roadmaster at Redfield, S.D., succeeding **R. C. Smith,** who has been transferred to Huron, S.D., where he replaces **A. J. Johnson,** who has been transferred to Green Bay, Wis., where he succeeds **V. L. Jozwiak,** who has retired. **L. G. Riehm,** supervisor of gatemen and flagmen at Chicago, has been promoted to assistant roadmaster, with headquarters at Mayfair, where he succeeds Mr. Olson.

H. J. McNally, supervisor of track on the St. Louis division of the Pennsylvania, at Greenville, Ill., has been transferred to the New York division main line, with headquarters at New Brunswick, N.J., succeeding **J. P. Zearley,** whose promotion to assistant division engineer, at Baltimore, Md., is reported elsewhere in these columns. **E. E. Zacharias,** supervisor of track on the Delmarva division, at Harrington, Del., has been transferred to Greenville, replacing Mr. McNally. **M. B. Miller,** assistant supervisor of track on the Maryland division, has been promoted to supervisor of track, Delmarva division, with headquarters at Harrington, succeeding Mr. Zacharias. **W. G. Goellner,** assistant supervisor of track, Williamsport division, at Williamsport, Pa., has been transferred to the Maryland division, with headquarters at Wilmington, Del., replacing Mr. Miller. **W. E. McColgin,** assistant on the engineer corps, Middle division, at Altoona, Pa., has been promoted to assistant supervisor of track, with headquarters at Williamsport, succeeding Mr. Goellner.

Special

W. E. Kropp, supervisor maintenance of way equipment on the Lehigh Valley, at Bethlehem, Pa., has been appointed supervisor maintenance of work equipment, with headquarters at Wilkes-Barre, Pa.

Obituary

George W. Feagin, who retired in 1937 as a locating engineer on the Louisville & Nashville, died on August 5 at Webster Groves, Mo.

Charles A. Paquette, who served as chief engineer on the Cleveland, Cincinnati, Chicago & St. Louis from 1915 to 1923, died recently at Sturgis, Mich.

D. K. Wickham, roadmaster on the Pocahontas division of the Norfolk & Western, at Iaeger, W.Va., died on August 10, as a result of a rail motor car accident.

U. M. Kress, engineer of water service on the Union Pacific, with headquarters at Denver, Colo., died in that city on September 4, after a short illness. Mr. Kress, who had 43 years of service with the road, first entered its employ in 1903 as an assistant chemist. In 1916 he became a member of the staff of Dr. William Barr, research and standards consultant for the company, with headquarters at Omaha, Neb. He engineered the erection of the road's first water softener and supervised all other installations made throughout the system. He was stationed at Valley, Neb., and Columbus and other points on the line prior to his transfer to Denver.

Buda Jacks—Bulletin 1040-D has been published by the Buda Company, Harvey, Ill., which describes and illustrates all of its various models and types of ratchet, screw and hydraulic jacks.

Simplex Jacks—Templeton, Kenly & Co., Chicago, has issued a 4-page pocket-size catalog on its line of Simplex jacks. Mention is included of a number of new products, such as the 30- and 50-ton hydraulic jacks, and a track shifter.

Electric Tools—The Syntron Company, Homer City, Pa., has issued Catalog 464, which illustrates and describes the complete line of Syntron electric tools and equipment, among which is included portable electric hammers, tie tampers, drills, screwdrivers, nut runners, grinders, sanders and semi-portable hack saws.

Sheet Piling—The Caine Steel Company, Chicago, has recently published a 16-page illustrated booklet describing this company's Corr-Plate steel sheet piling, its various shapes and its uses in connection with the construction of bulkheads, retaining walls, dams, shore and flood protection, deep trench work, and soil erosion projects.

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Salient Features of the Fordair

COMPACTNESS—actual dimensions of both motor and compressor only 34 x 34 x 24 inches.

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Besides the four mountings pictured below, the Fordair is available in a skid mounting and as a "Powair" unit replacing the motor of a Ford V-8 truck. Other Schramm models too, with capacities up to 420 cubic feet actual air. Send for the complete Schramm catalog.

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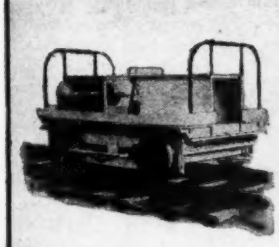
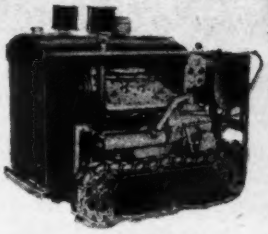


Fordair Model 60 Railcar



Fordair Model 60 Crawler

Fordair Model 60 Tampair

Fordair Model 60 Standard Two-wheel Trailer

Association News

Maintenance of Way Club of Chicago

The first fall meeting of the club will be held on October 28 in new headquarters, in Harry Burke's Restaurant in the Railway Exchange Building, 80 E. Jackson Blvd. The feature of the meeting, which will begin with the usual dinner at 6:30 p.m., will be the showing of the Ramapo-Ajax motion picture of the recent installation of 27 pre-assembled units of special track work in the multiple-track crossings of the Chicago & North Western and the Chicago, Milwaukee, St. Paul & Pacific at Western Avenue, Chicago, which will be accompanied by a description of the work by L. R. Lamport, engineer of maintenance of the North Western.

American Railway Engineering Association

It is expected that the remaining copies of the 1945 Proceedings—those with cloth bindings—will be mailed to members immediately after October 1.

Six standing committees have scheduled meetings to be held in October. These include the Committee on Rail, to meet on October 30; the Committee on Water Service and Sanitation, to meet on October 15; the Committee on Iron and Steel Structures, to meet on October 23 and 24; the Committee on Wood Preservation, to meet on October 17; the Committee on Economics of Railway Labor, to meet on October 18; and the Committee on Waterproofing, to meet on October 10 and 11. All these meetings will be held at Chicago except that of the committee on Waterproofing, which will be held at New York.

In September, 11 committees held meetings, including the Committee on Roadway and Ballast on September 18 and 19; the Committee on Track on September 17; the Committee on Buildings on September 16 and 17; the Committee on Masonry on September 17 and 18; the Committee on Highways on September 24; the Committee on Records and Accounts on September 20 and 21; the Committee on Water Service and Sanitation on September 4; the Committee on Yards and Terminals on September 24 and 25; the Committee on Economics of Railway Location and Operation on September 26 and 27; the Committee on Uniform General Contract Forms on September 9; and the Committee on Maintenance of Way Work Equipment on September 16. All these meetings were held at Chicago except two, that of the Committee on Records and Accounts, held at Cleveland, and that of the Yards and Terminals Committee, held at Roanoke.

Stonhard Products—Recently published by the Stonhard Company, Philadelphia, Pa., is the Railroad Bridge and Building Maintenance Handbook, which describes the company's products and their application to the railway field for making repairs to concrete structures, surfacing floors, protecting steel, and waterproofing.

Supply Trade News

General

The **Union Asbestos & Rubber Company** of Chicago has announced a program to expand its Blue Island, Ill., plant. The program involves the installation of additional heavy machinery and equipment to be completed in the early fall, and the extension of several buildings scheduled for completion by the first quarter of 1947.

A two-year expansion program at the Fairfield sheet mill of the **Tennessee Coal, Iron & Railroad Co.**, Birmingham, Ala., a United States Steel subsidiary, has begun, which will result in the conversion of the mill from the hot-rolled process of producing sheets to the cold-rolled method. Equipment for the production of galvanized sheet metal in coils will also be added to the mill as a part of the modernization program.

Personal

H. A. Wolfe, railroad representative of **The Buda Company,** at St. Paul, Minn., has been appointed district manager of Buda's railroad division with headquarters at Chicago, succeeding **Ross M. Blackburn,** whose death at Chicago on July 25 was reported in the August issue. **William A. Hart,** railroad representative at New York, has been transferred to St. Paul, Minn., to replace Mr. Wolfe.

Mr. Wolfe was born in 1897, and received his higher education at Valparaiso University, Valparaiso, Ind. He entered railroad service in 1916 in the accounting

H. A. Wolfe

department of the Chicago, Milwaukee, St. Paul & Pacific. Released from the armed forces in 1919, he returned to the Milwaukee as chief clerk to the general superintendent of motive power, and served in that capacity until 1922, when he was promoted to supervisor of fuel. In 1926 Mr. Wolfe resigned from the Milwaukee to become special representative of the Lehon Company. In 1940 he was promoted to supervisor of railroad sales and held that position until May, 1944, when he joined Buda as field representative. In April, 1946, he was transferred to St. Paul, Minn., and served there until he assumed his new duties at Chicago.

Mr. Hart was born at Battle Creek, Mich., and was graduated from Purdue University in 1940 with a B.S. degree in mechanical engineering. In the same year he joined the Buda sales department at Harvey, Ill. Early in 1941 he was transferred to New York to represent the railroad division in export and industrial sales through distributors, and served in that capacity until he entered the service of the armed forces early in 1942. In November, 1945, he returned to The Buda Company and was sent to New York to represent the industrial division in the northeastern territory, where he served until his recent transfer to St. Paul.

S. S. Bruce has been appointed manager of the newly established traffic and transportation department of **Koppers Company.** Mr. Bruce, formerly traffic manager,

S. S. Bruce

has been associated with the company since 1916. In his new position he will supervise purchase, operation, and maintenance of motor, rail and water transport, in addition to handling traffic.

H. H. Landis has been appointed eastern division sales manager of the **Joyce-Cridland Company,** with headquarters at Dayton, Ohio.

F. L. Coventry has been appointed chemical engineer for the **Dearborn Chemical Company,** with headquarters at Urbana, Ill.

James G. Mowry, industrial paint salesman for the paint division of the **Pittsburgh Plate Glass Company,** has retired after 45 years of service. The company has announced that the sales of railway finishes in the eastern territory will be handled by officers in New York, Baltimore, Md., and Pittsburgh, Pa. **John Leonard** will handle sales in New York; **Glenn N. Stanford** will handle sales at Baltimore; and **Jack A. Burke** will handle sales at Pittsburgh.

H. J. Harp has been appointed sales engineer of internal feed water treatment for the Philadelphia area for the **Permutit Company,** with headquarters at 34 South 17th street, Philadelphia, Pa. Mr. Harp

(*Continued on page* 1098)

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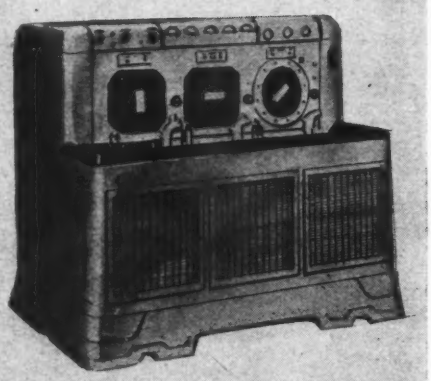

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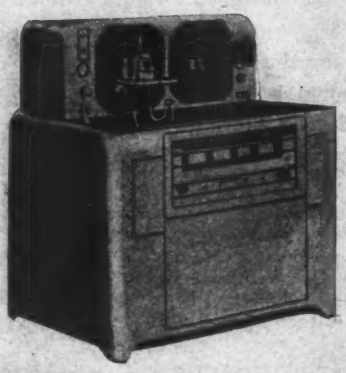

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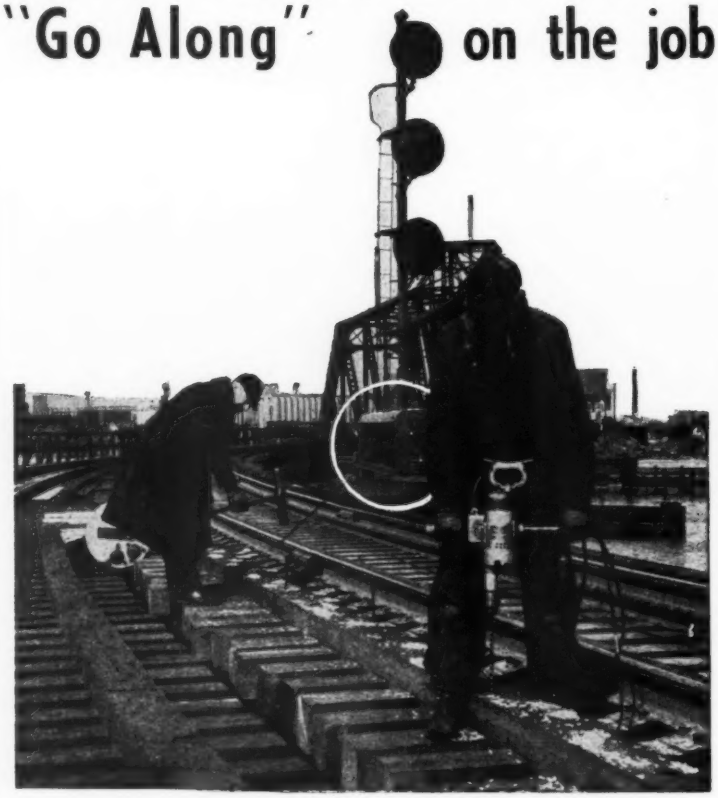

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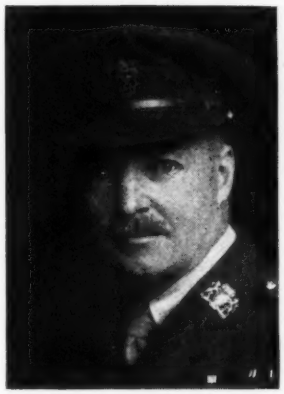
REPRESENTATIVES IN ALL PRINCIPAL CITIES

(*Continued from page* 1094)

is national treasurer of the Association of Power Engineers and recently served as a mechanical engineer with the Army Air Force. He was formerly instructor in power plant engineering at the Williamson Trade School, chief engineer of the Delaware Jute Mills, and power chief at Charles P. Lenning, Philadelphia.

Col. Lewis P. Winby has been elected chairman of the board of the **P. & M. Company (England) Ltd.** and **A. C. Meyrick,** managing director. Mr. Winby was graduated from Cambridge university, and during the South African war, was one of two honor students at the university chos-



Col. Lewis P. Winby

en for commissions in the British Army. He attained the rank of major in that war, and at the outbreak of World War I, because he was not a reserve officer, entered service as a lieutenant. He served until the war's end, attaining the rank of Lieutenant Colonel. In 1919 he organized the P. & M. Company (England) Ltd., taking a license on all patents owned, and hereafter acquired, by the P. & M. Company of the United States. Mr. Winby was elected to parliament in 1925, and sat in the House of Commons for a number of years. The firm, of which he is chairman, has subsidiary companies in Australia, France and Belgium, and large offices in Calcutta, India.

The Permutit Company has acquired the Simplex Valve and Meter Company of Philadelphia, Pa. **H. W. Foulds,** president of Permutit, succeeds **W. H. Roth** as president of Simplex. Mr. Roth becomes chairman of the Simplex board.

T. J. Flynn, recently released from the armed forces, has resumed his duties in the south-eastern sales office of the **American Lumber & Treating Co.,** Jacksonville, Fla.

J. R. Mooney has been appointed general manager of the **Texasteel Manufacturing Company,** Ft. Worth, Tex. He was previously manager of the rail and fastenings department of the Robert W. Hunt Company, Chicago.

The **Byron Jackson Company,** Los Angeles, Cal., has announced the acquisition of the Butte Pump & Motor Works, Chico, Cal., which will be operated as a division

(*Continued on page* 1100)

Like Most Large Private Contractors USE

ROYCE KERSHAW
COMPANY, INC.
RAILROAD CONTRACTORS

JACKSON VIBRATORY TIE TAMPERS

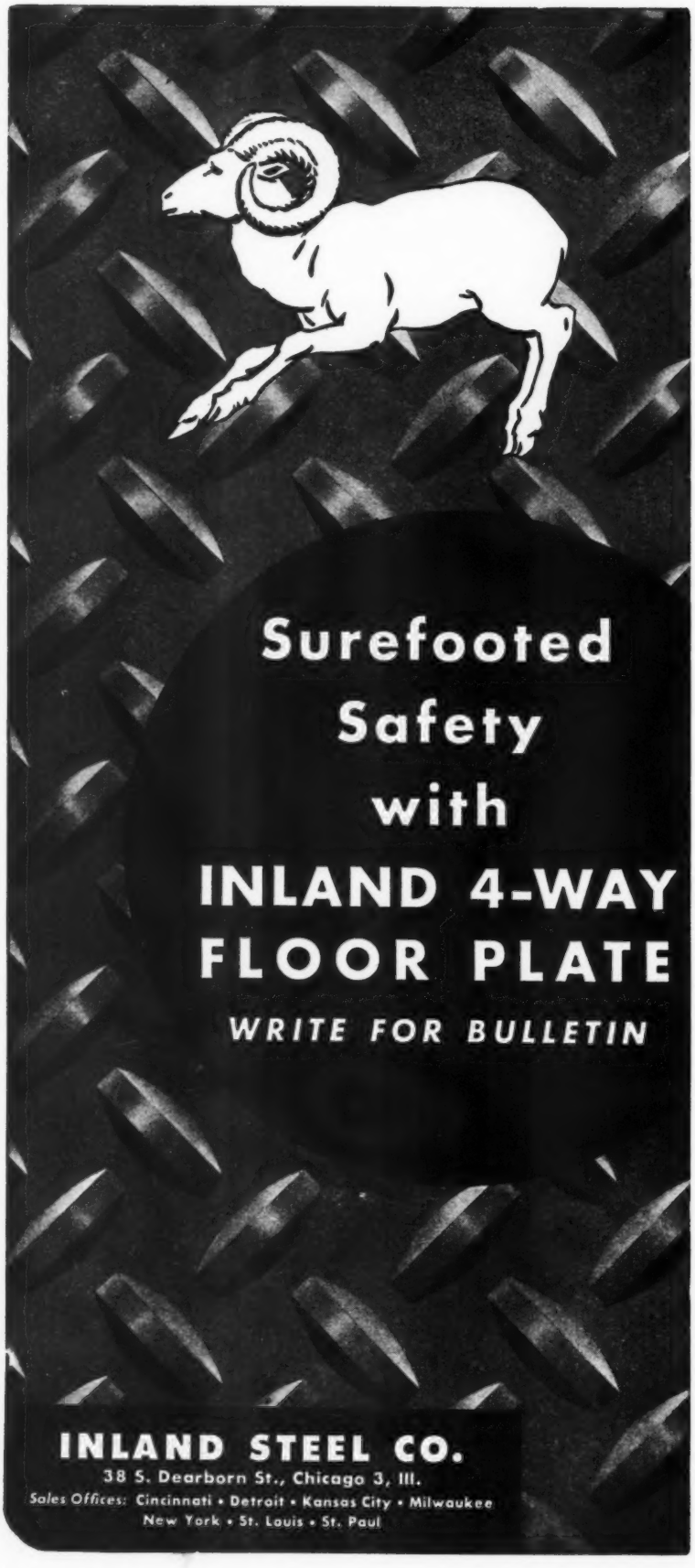
The June issue of "Construction Methods" contains a very interesting illustrated account of the complete reconstruction and reconditioning of the Atlantic Coast Line Railroad Company's track between Savannah, Ga., and Jacksonville, Fla., by Royce Kershaw Company, Inc., private contractors. Many ingeniously devised special machines are employed to expedite the job in the face of shortage of labor. *"All tamping," says C. M., "is done with Jackson electric tampers."* And that, in our estimation, constitutes another bit of indisputable evidence that with men who are track experts, whose work must stand the most exacting inspection, JACKSON Vibratory Tampers offer the fastest, most economical means of doing the best possible job of ballast placement.

Let us show you how JACKSON Tampers and Power Units can be used to far outstrip any other tie-tamping equipment in quantity and quality of track maintained.

Construction personnel on railroad track project includes (left to right): W. J. Aldridge, chief inspector, Atlantic Coast Railroad; Royce Kershaw, general manager, and O. Smith, general superintendent, Royce Kershaw Co., Inc.

Two WS-4 Jackson Power Plants mounted on push car are used to power eight Jackson Tampers.

ELECTRIC TAMPER & EQUIPMENT COMPANY
LUDINGTON MICHIGAN



(*Continued from page* 1098)

of the Byron Jackson Company with no change in name. **A. F. Vonnegut** has been appointed manager of the new division.

Robert D. Evans has joined the sales development division of the **Caterpillar Tractor Company** as consulting civil engineer on earth-moving equipment and its applications. He was previously chief field engineer for R. G. LeTourneau, Inc.

E. J. McGehee has been appointed sales manager of **Koppers Company, Inc.** Mr. McGehee, also a vice-president of the company, in his new capacity will coordinate Koppers sales activities on a company-wide basis and will retain his Pittsburgh, Pa., headquarters.

Mr. McGehee first became associated with the Koppers organization in 1934, and since that time has served in various executive positions in connection with the

E. J. McGehee

company's production and sale of pressure-treated timber for railway and utility work. He was appointed a vice-president in 1941. Before joining Koppers, Mr. McGehee was a production and sales executive of the Ayer & Lord Tie Company, which subsequently was purchased and merged with the Koppers Company. He is a past-president of the Railway Tie Association and a member of the Western Railway Club, the New York Railway Club, the Pittsburgh Railway Club, and the American Wood Preservers' Association. He is chairman of the Wood Industry Advisory Committee of the Office of Price Administration and secretary and treasurer of the Eastern Railroad Cross Tie Advisory Committee.

William E. Wilkins, who prior to his call to active military duty in 1941, was assistant to the sales manager of the **American Lumber & Treating Co.** at Boston, Mass., has returned to the company as a member of its New York sales staff.

Wendell Richards, district sales representative of **R. G. Le Tourneau, Inc.,** at Pittsburgh, Pa., Philadelphia, and Baltimore, Md., has been promoted to market research manager. **O. A. Williams,** district sales representative in Ohio, Indiana, and Michigan, has been appointed eastern sales manager, succeeding **Harry Cone,**

(*Continued on page* 1102)

ORTON

RAIL UTILITY CRANES

Proved through the years the smoothest-operating, fastest light "on track" machine built.

- **AIR CONTROLS**
- **ANTI-FRICTION BEARINGS**

1 ANTI-FRICTION BEARINGS THROUGHOUT.

2 AIR-OPERATED CONTROLS THROUGHOUT.

3 INDEPENDENT TRANSMISSION, WITH BUILT-IN REVERSE, ALLOWS LOWERING AGAINST COMPRESSION.

4 COMPLETELY AUTOMATIC SPRING-APPLIED, AIR-RELEASED BOOM-HOIST BRAKE. POSITIVELY PREVENTS DROPPING OF BOOM.

5 AIR-CONTROLLED LIMIT-SWITCH PREVENTS PULLING THE BOOM OVER BACKWARDS.

6 SINGLE-POINT ADJUSTMENT V-TYPE ORCOIN BLOCK CLUTCHES, WHICH CANNOT GET OUT OF ROUND.

CATALOG 78 GIVES THE DETAILS. SEND FOR IT.

ORTON CRANE & SHOVEL COMPANY
608 S. DEARBORN ST., CHICAGO 5, ILL.

SENSITIZED

POWER

(*Continued from page* 1100)

who has resigned. **C. F. Zimmerman,** general service manager, succeeds Mr. Williams as district sales representative. **Cloyd Richards,** assistant service manager, has been appointed general service manager, succeeding Mr. Zimmerman. **H. R. McQuarrie,** eastern credit manager, has been appointed assistant to the domestic sales manager, a newly-created position.

Ernest S. Theiss has been appointed assistant chief engineer of the **Davey Compressor Company,** Kent, Ohio. For the past seven years he has served as assistant professor in the department of mechanical engineering at Duke University.

John C. Tracey has been appointed sales engineer of the Washington, D.C., office of the **Permutit Company.** Mr. Tracey was formerly a lieutenant colonel with the United States Army Engineers.

Ray D. Cunningham has been appointed director of sales of the **Nox-Rust Chemical Corporation, Chicago.** He was previously general sales manager of the Wolf's Head Oil Refining Company, Oil City, Pa.

Clarence H. Collier, Jr., has been appointed manager of the industrial lift truck eastern division of the **Hyster Company,** with headquarters in Peoria, Ill.

D. W. McNaugher, Jr., vice-president of the **Robert W. Hunt Company,** Chicago, has also been appointed treasurer. **S. C. Sexauer,** assistant secretary, has been appointed secretary.

R. G. LeTourneau, Inc., Peoria, Ill., has announced the appointment of two new specialized distributors under its railroad sales and service agreement. They are the **Miller G. Williams Machinery Co.** of Montgomery, Ala., and branch at Birmingham; and the **Soule Equipment Co.,** of Oakland, Cal., with branches at Sacramento and Stockton, Cal.

John E. Fogarty, formerly manager of the weldment division of the **Graver Tank & Mfg. Co., Inc.,** has been appointed general manager of the company's Sand Springs, Okla., plant. **Edward B. Heyden,** formerly with the Lummus Company, has been placed in charge of Graver's construction division, replacing **Lloyd K. Wells,** who has retired.

Obituary

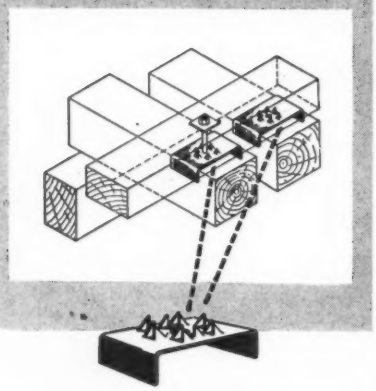
Ralph D. Prettie, formerly president of the Northern Wood Preservers Ltd., Port Arthur, Ont., died at his home in that city on August 13, at the age of 63. For 20 years before entering the wood preserving and creosoting field in 1923, Mr. Prettie was superintendent of forestry on the Canadian Pacific at Winnipeg, Man., and Calgary, Alta.

Flextite.—The Flexrock Company, Philadephia, Pa., has published a folded brochure describing the applications of Flextite, a compound used as a cement admixture for stopping leaks, waterproofing, damproofing, etc.

TECO

CLAMPING PLATES

tie 'em down



Use TECO clamping plate timber connectors for rigidly attaching ties to guard timbers with low maintenance cost.

Bolts are used in every third or fourth tie with lower replacement costs.

Write for FREE design data for using clamping plates.

TIMBER ENGINEERING COMPANY
1319 18th St., Washington 6, D. C.

Please mail me free design data for using Teco Clamping Plates.

Name.....

Company.....

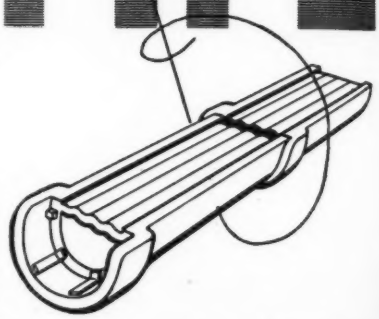
City.....

State.....

REM

SKIP PIPE

WORTH WAITING FOR



REVOLUTIONIZING TRACK AND YARD DRAINAGE

DICKEY SKIP-PIPE is the one pipe that is designed especially for subdrainage. The corrugated cradle literally funnels percolating water into the pipe *in the direction of flow.* Tests prove that SKIP-PIPE drains faster and deeper than other pipes. The strong, dense vitrified clay body is absolute proof against rusting, rotting or disintegration by chemicals. SKIP-PIPE can be used safely in cinder backfills. Already in use on many main lines.

WRITE FOR FULL DETAILS

W S Dickey CLAY MFG. CO.

Kansas City 6, Mo. Birmingham 1, Ala.
Chattanooga 2, Tenn. San Antonio 7, Texas
Texarkana, Tex.—Ark.

30 YEARS PLUS...

and still in service!

THIS J-M ASBESTOS SHINGLE ROOF

BACK IN THE YEAR 1914, this attractive roof of Johns-Manville Asbestos Shingles was applied on the Troy, Alabama, station of the Atlantic Coast Line Railroad.

Today, after more than 30 years' exposure, its lines are as true, its protection against sun, wind and rain as complete as the day it was put on!

You won't have to look far to find other "old timers" with similar records among the many roofs of J-M Asbestos Shingles in railroad service. For these sturdy shingles are built to last. Fireproof as well as rotproof, not one has ever burned or worn out. Maintenance in most cases has been next to nothing!

Find out just how little it will cost you to give the buildings along your right-of-way this same enduring, low-cost protection. For complete information, write Johns-Manville at New York, Chicago, Cleveland, St. Louis or San Francisco.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

88 YEARS OF SERVICE TO TRANSPORTATION

Trade Publications

Folder Describes Mobile Machine Shop—The Davey Compressor Company, Kent, Ohio, has issued a folder describing its new truck-mounted machine shop which is said to include all the equipment ordinarily assembled in large central repair shops.

Teco Typical Lumber Designs—The Timber Engineering Company, Washington, D.C., has published a 12-page booklet containing sketches of various designs of timber trusses and listing the live and dead loads applicable for many span lengths and depths. Included also are diagramatic designs and information relative to towers, bridges, trestles and highway structures.

Emeri-Crete Floors.—Walter Maguire Company, Inc., 330 West 42nd Street, New York, has published an eight-page bulletin, No. 601, describing Emeri-Crete flooring. The bulletin explains the application, wearing qualities and safety features of Emeri-Crete and is well illustrated with photographs of this type flooring installed in locations where it is subjected to heavy trucking and other severe service conditions.

Sludge Pumps.—Marlow Pumps, Ridgewood, N.J., has published a 12-page bulletin, No. M45, featuring its "Mud Hog" diaphragm pumps. The bulletin, which is well illustrated and attractively printed in color, describes the construction features of this type of pump, and presents specifications on the various models of both gas-engine powered and electric models. The bulletin also devotes two pages to brief descriptions of the plunger pumps and self-priming centrifugal pumps manufactured by the company.

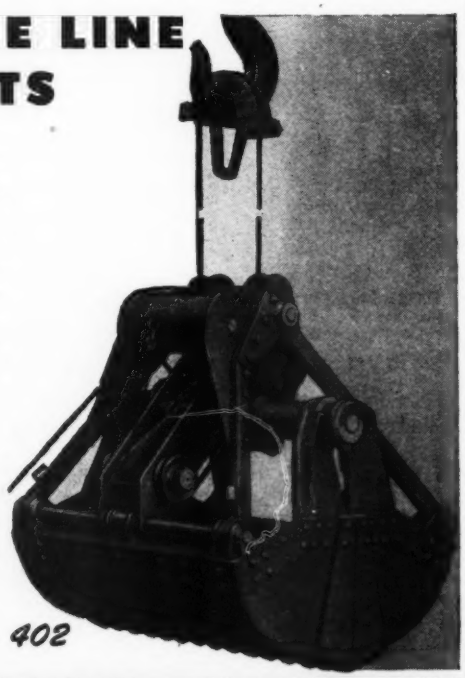
Floor Coating Bulletin—The Flintkote Company, New York, has published a two-page bulletin dealing with its recently-developed anti-slip floor coating product Flintdek (changed from the previously announced name of Flintred). The bulletin describes the uses of Flintdek and its methods of application to steel, galvanized iron, wood, concrete, and tile surfaces.

Technical Bulletin on Metal Hardening—The Metal & Thermit Corporation, New York, has published a 16-page bulletin on the hard surfacing of metals and the use of its Hardex arc-welding electrodes in building up surfaces for resistance to shock and abrasion. It contains helpful information concerning such matters as the effect of temperature and cooling rates on deposited metal, selection of the proper grade of rod, and recommended welding techniques, supplemented by charts and tables.

Welded Erection System.—J. H. Williams & Co., Buffalo, N.Y., has published Bulletin No. 4 (4 pages) describing the Saxe welded erection system and the advantages in using this method for the shop fabrication or field erection of welded structures. The Bulletin reproduces a number of testimonial letters from concerns which have used this system.

(*Continued on page* 1106)

ERIE SINGLE LINE BUCKETS



ILLUSTRATED is the hook-on type, for intermittent service. It is reeved and ready for operation on overhead traveling crane, monorail hoist, locomotive crane, derrick, ships tackle or any other hoisting device which has but a single hoisting drum available for bucket duty. Just slip the yoke over the crane hook.

Erie Single Line buckets are also available in the direct-reeved type for permanent installation. Describe your Single Line bucket need — we'll give you our recommendations for we build all types and sizes.

● *Write for Booklet 402*

ERIE BUCKETS • *A Complete Line*

Erie Steel Construction Co., 11610 Geist Rd., Erie, Pa.

BUCKETS • AGGREMETERS • PORTABLE CONCRETE PLANTS

for SPEED ...Specify STEEL Sheeting

Sheeting jobs, whether permanent or temporary, are done quickly and economically with ARMCO Steel Sheeting. Check these advantages in railroad construction:

SAFE STRENGTH . . . ARMCO Sheeting is corrugated to assure ample strength with light weight. It makes for easy handling and quick installation.

EASY TO DRIVE . . . Light weight and small displacement area simplify driving. Sections butt together or are held securely in place by continuous interlocking joints that assure the right alignment and practical water-tightness.

LOW COST . . . Besides economy of installation, ARMCO Sheeting is low in first cost. You buy the exact weight you need. Repeated use of the sheeting makes average job costs surprisingly low.

ARMCO Sheeting is nestable and requires little space for shipment and storage. Write us for prices and detailed information on how ARMCO Steel Sheeting can fit your needs. Armco Drainage & Metal Products, Inc. and Associated Companies, 1735 Curtis Street, Middletown, Ohio.

ARMCO

Armco Sheeting

Save TIME and COSTS on Tie-Replacement Jobs the *Woolery* Way

The WOOLERY TIE CUTTER is the modern answer to the perennial problem of removing old ties:—a sturdy light-weight machine (easily operated by one man), which makes possible savings of 30% or more in tie-replacement costs.

End sections of cut tie are easily pried out with a bar, using center section as a heel.

Center section is lifted out, leaving ballast intact, practically ready to receive new tie.

In action, its reciprocating cutting blade slices through the old tie just inside the rail, to make three easily-removed pieces. It averages 50 cuts per hour, including all delays and time necessary for moving, and permits track to remain in service with rail and tie bed undisturbed.

We invite your inquiry for detailed cost and operating data.

Every WOOLERY TIE CUTTER is guaranteed.

WOOLERY MAINTENANCE MACHINES

Tie Cutters **Weed Burners** **Creosote Sprayers**

Available in 5-burner, 3-burner, 2-burner, and 1-burner models.

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS · MOTOR CARS · TIE CUTTERS · TIE SCORING MACHINES · RAIL JOINT OILERS · CREOSOTE SPRAYERS · BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES PRESSED STEEL CAR COMPANY INC PITTSBURGH PENNA

(*Continued from page* 1104)

Hexteel Floor Surface Armor—The Wm. F. Klemp Company, Chicago, has issued a six-page illustrated broadside describing the applications of Klemp Hexteel Heavy-Duty Surface Armor to industrial flooring. Included are step-by-step, illustrated descriptions of the construction of a new floor using Hexteel and the repair of a damaged section of an older floor, with this material.

Building Maintenance—The Stonhard Company, Philadelphia, Pa., has recently published a four-page illustrated folder which outlines the characteristics, advantages, typical uses, and application of its maintenance materials for floors, walls and roofs. Information is included on floor preservatives, roof resurfacers, concrete surface treatment and waterproofing.

Pressure-Welded Rail on Bridges—The Oxweld Railroad Service Company, Chicago, has reprinted as a four-page illustrated pamphlet, a recent article from *Railway Engineering and Maintenance* entitled "Illinois Central Overcomes Adverse Conditions on Cairo Bridge." It discusses the details of the application of oxyacetylene, pressure-welded rail to the Illinois Central bridge at Cairo, Ill., including the work of moving the long rails from the welding site to the bridge.

Electrode Selection Chart—The Air Reduction Sales Company, New York, is distributing a graphic, four-color, 25-in. by 40-in. electrode selection chart to assist electric welders in choosing the proper electrode for a particular job. The chart includes a general description and gives the mechanical properties of each of 43 types of electrodes and shows the proper currents to use with each. A feature of the chart is an electrode color guide in which the electrodes are shown in their actual colors. The chart is arranged in tabular form with the electrodes grouped according to use. Included are electrodes suitable for use with mild, alloy and stainless steels, cast iron, and non-ferrous metals. Also included are sections for hardfacing and surfacing rods, and for special service electrodes.

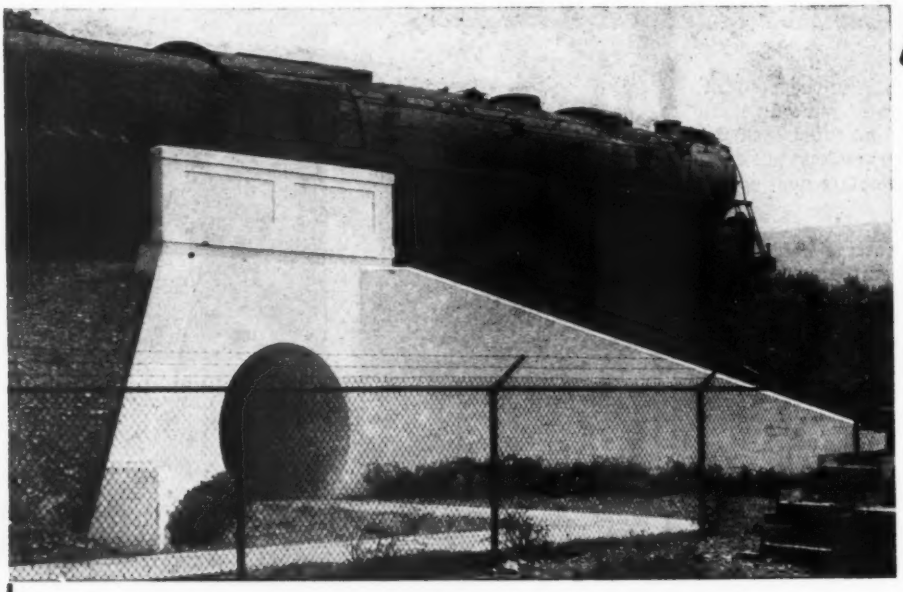
Air-Operated Tools.—The Ingersoll-Rand Company, Phillipsburg, N.J., has published a pocket-size folder entitled "Air-Operated Tools for Maintenance, Construction, Demolition", which shows at a glance the line of I-R air tools and portable compressors available for such work. Information is given as to size ranges and model variations, and a number of photographs illustrate the use of air tools. Several of these show new uses for well-known tools. Various accessories to air-tool operation are also shown.

Buda Earth Drills—The Buda Company, Harvey, Ill., has issued an eight-page booklet describing the several types of earth drills that are manufactured by this company. The booklet is well illustrated with pictures showing the details of the various models and their applications. A tabular list in which the specifications of each type of drill are shown, is also included.

Wrought Iron—The A. M. Byers Company, Pittsburgh, Pa., has published a 36-page revised issue of its booklet, "101 Uses for Wrought Iron," which pictorially presents the various uses of wrought iron piping, bars and flat-rolled products, including many in the railroad industry. Depicted among the many applications of wrought iron in this field are floor, blast and brine plates on bridges, railings, drain gratings, downspouts, fire-protection sheets for viaducts and bridges, water pans, smokejacks, roof plates for tunnels, locomotive staybolts, piping and boiler washing systems.

Diesel Tractors—An illustrated 24-page catalog emphasizing numerous features of the new HD-7 Diesel tractor is being distributed by the Allis-Chalmers Manufacturing Company, Tractor division, Milwaukee, Wis. The catalog lists the facts about the engine, unit injector, transmission construction, and sealed truck wheels, and gives specifications with pertinent facts and figures.

Jack Maintenance and Repair Manual—A 48-page catalog, No. 45, has been prepared by Templeton, Kenly & Co., Chicago, manufacturers of Simplex jacks, which is designed to assist users of its line of lever and hydraulic jacks in ordering replacement parts. The catalog lists parts by number for the various types and sizes of jacks in use, includes a list of interchangeable parts for these jacks, and presents, with illustrations, many suggestions for the maintenance, lubrication and repair of Simplex jacks.



No "SLOW" ORDERS ON THIS JOB

Sixty-nine feet of 96" concrete pipe was jacked through this Elmira, N. Y., fill of the D.L. & W. in 8 days *without slowing* traffic.

UNIVERSAL CONCRETE PIPE Provides—

ample strength and high wear resistance for the construction of pedestrian underpasses. Pipe to 108" carried in stock in our many plants.

Write for full information on installation shown above and concerning similar jobs.

UNIVERSAL
Concrete Pipe Co.,
297 S. High St.
COLUMBUS 15, OHIO

When You Repower

DIESEL'S THE POWER . . . *Sheppard's* THE DIESEL!

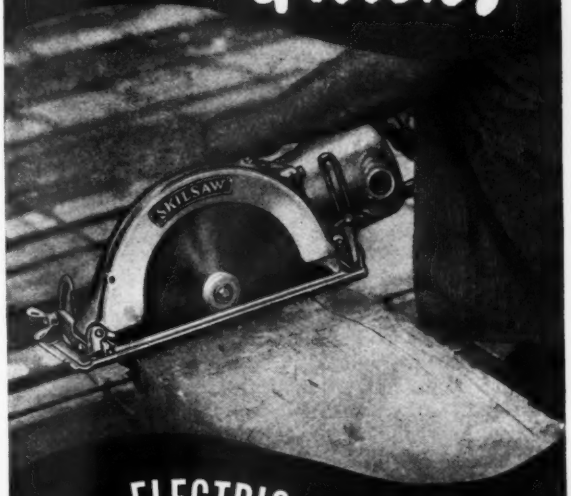
A Sheppard Diesel will deliver its full rated horsepower to your dragline, shovel, crusher, pump or compressor for long periods of continuous operation . . . will stand the shock of sudden load changes without dragging or racing . . . will emphatically reduce fuel and maintenance costs. If you have a piece of equipment that needs a new power plant, remember . . . "Diesel's the Power . . . Sheppard's the Diesel." Write for 16 page booklet and see why for yourself.

Generating Sets, 2,000 to 36,000 watts
Power Units,
3¾ to 56 continuous H. P.,
operating fully equipped

Sheppard

R. H. SHEPPARD COMPANY, INC.
36 Middle St., Hanover, Pa.

This is the Portable SAW that CUTS 8 x 16's *Quick!*



12 IN. ELECTRIC or PNEUMATIC

SKILSAW!

● Either model cuts 4⅜ in. deep, rips or crosscuts 8-inch timbers in two quick cuts. Electric SKILSAW operates from power lines or portable generators on voltages up to 250 v. Pneumatic SKILSAW operates at maximum horsepower on 75 cu. ft. of free air under 80 to 100 lb. air pressure. Both SKILSAWS go right to the job, save time, labor, material handling . . . step up the output of your construction gangs. Ask your distributor today for a demonstration.

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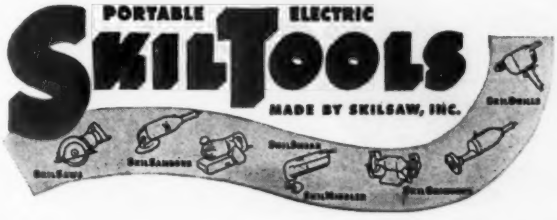
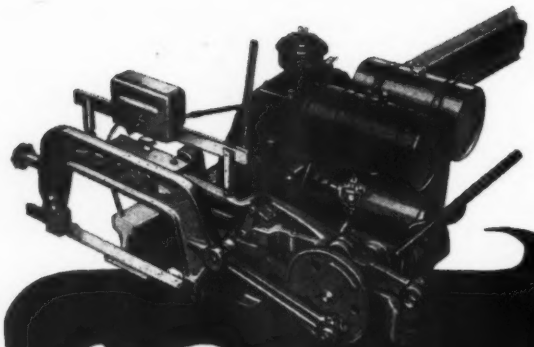
5033-43 Elston Ave., Chicago 30, Ill.
Factory Branches in All Principal Cities

PORTABLE ELECTRIC
SKILTOOLS
MADE BY SKILSAW, INC.





Cut Rail . . .
RIGHT ON THE TRACK
with . . .

RACINE PORTABLE Rail Saws

Your track maintenance and repairs can be speeded up with Racine Portable Rail Cutting Machines. This equipment cuts rail ends right on the track. No extra handling or hauling of the rail to central cropping plant.

Only one man needed to operate the Racine Rail Saw. Two men can easily carry it from rail to rail. These fast, accurate machines produce smooth, clean cuts without the overheating of rail ends that so often starts fractures leading to rail failure. Model 15 for rails to 7⅜" high; Model 16 for rails to 10" high.

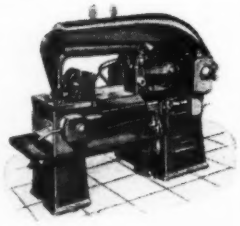
SIX COMMON JOBS FOR THIS MACHINE

1. Cutting and fitting rails at interlocking plants, crossings and switches.
2. Closing track in rail-laying operations.
3. Smooth, accurately cut rail for insulated joints.
4. Proper staggering of joints in curves.
5. Removing split, worn and battered rail ends.
6. Cutting out sections of wheel burned rails and fissures.

Models are available with gas engines, compressed air or electric motors. Write for complete catalog No. 58A. Address RACINE TOOL AND MACHINE CO., 1738 State St., Racine, Wisconsin.

RACINE HEAVY DUTY METAL SAWS FOR RAILROAD SHOPS

Cut axle shafts, boiler pipe, channels, angles and beams quickly and accurately. Models are available in all price ranges for either high speed production metal cutting or general all around shop work. Capacities 6" x 6" to 20" x 20". Ask for general catalog No. 12 giving description of complete Racine Saw line.



STANDARD FOR QUALITY AND PRECISION
RACINE
RACINE TOOL and MACHINE CO.

RACINE

"TODAY'S unprecedented need for peacetime goods is a challenge to American industry. More things must be produced faster, better and at lower prices. Wherever ferrous metals are handled—whether scrap or finished products—the job can be done faster, better, safer and at lower costs with Ohio 'Extra Strength' Lifting Magnets. Ohio engineers are experts in the solution of metal handling problems. If you need advice on the moving of iron or steel in any form, do not hesitate to send your problem to The Ohio Electric Manufacturing Co. No obligation of course."

CHESTER BLAND, Pres.

'Application Proved' . . .

- Lifting Magnets
- Separation Magnets
- Magnet Controllers
- Weatherproof Connectors
- Fractional Horsepower Motors

THE OHIO ELECTRIC MFG. CO.
5905 Maurice Avenue • Cleveland 4, Ohio

Model W9 Electric Saw

Get More Handpower For Less Cost With Stanley Electric Saws

UNSURPASSED FOR SPEED AND STABILITY

STANLEY

Trade Mark

HARDWARE · HAND TOOLS · ELECTRIC TOOLS

STANLEY ELECTRIC TOOLS, NEW BRITAIN, CONNECTICUT

Creosoted { PILING POLES TIMBERS TIES

88 acres FOR PROPER SEASONING AND STORAGE...

McCormick & Baxter facilities are adjacent to the Douglas Fir region. Deep water dockage, rail sidings and our own timber assure prompt deliveries by water, rail or truck. Call on us for figures next time... you'll like our way of *delivering!*

McCORMICK & BAXTER CREOSOTING CO.

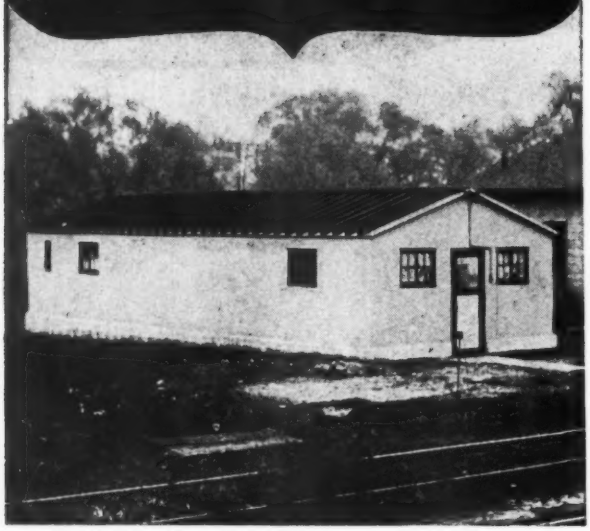
OFFICES:

BOARD OF TRADE BLDG., PORTLAND, OREGON
485 CALIFORNIA ST., SAN FRANCISCO, CALIF.

TREATING PLANTS:

STOCKTON, CALIFORNIA • PORTLAND, OREGON

Here is MORE for your building dollar



When you specify standard ARMCO STEELOX buildings for railroad structures you get two important advantages from your building dollar—long life and low upkeep.

Durable STEELOX prefabricated sections are made of heavy-gage ARMCO Galvanized PAINTGRIP steel sheets. The Bonderized surface of STEELOX panels can be painted immediately or left unpainted for economy.

WEATHER-TIGHT

STEELOX buildings are adaptable to many requirements. They can be quickly wired, easily insulated, or may be left uninsulated without affecting weather-tightness. The tight interlocking flanges help prevent penetration of dust, insects, or vermin. All steel construction is also an excellent fire-barrier.

STEELOX buildings are prefabricated in a wide range of standard sizes to fit your requirements. They are easy to handle and can be erected quickly by unskilled labor. When necessary they can be quickly dismantled and re-erected at another location.

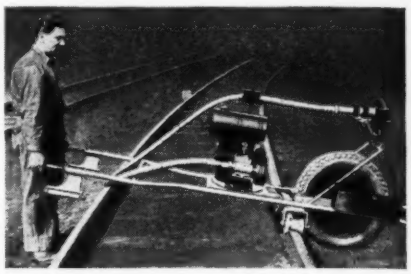
Get prices and the complete story of ARMCO STEELOX buildings by writing to Armco Drainage & Metal Products, Inc., 55 Curtis Street, Middletown, Ohio.

Armco

ARMCO

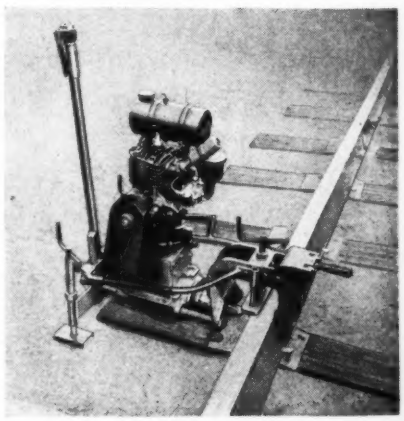
STEELOX BUILDINGS

EASIER, FASTER TRACK WORK with these NEW RTW MODELS



Portable Flexible-shaft Grinder, Model P-40

You'll like this new easier-to-handle grinder for both on- and off-track work. Transporting wheel adjusts to three positions by new, foolproof spring locking device — machine clears switches and crossovers with ease, levels quickly for off-track use, gets on and off track faster. Power-unit mounted on ball bearing turn table facilitates handling flexible shaft and attachments. Six hp. air-cooled gasoline engine or electric motor drive.



Power Track Drill, Model P-34-A

Superb balance, light weight . . . features you'll appreciate in this new track drill. Attached and removed from rail *fast*. Quick, accurate adjustment for leveling with rail and uneven ground; adjusts to various rail sizes. Lateral feeding of drill by ratchet gear and rack simplifies operation. Holes up to 1½" in less than a minute. Motor raises or lowers on frame. V-belts well guarded.

Get full details on these better, lighter, easier-to-work-with track machines. Bulletins on request.

Railway Trackwork Co.

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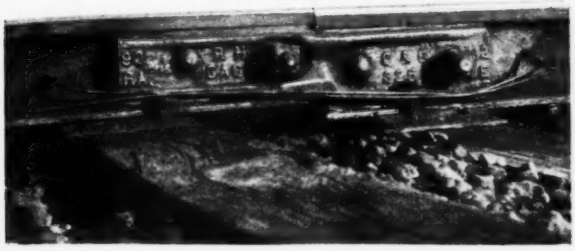
Track Appliances for SAFETY AND ECONOMY



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Q & C STEP JOINTS
For Dependable Service

Over a period of more than forty years, the manufacture of Q&C Step Joints has kept pace with the best practice for producing high-grade heat treated steel compromise joints that have the necessary qualities for resistance to the impacts of heavy service. If you will specify the correct allowance for wear on old rails, we can provide the best possible surface to prevent batter on the rail ends and reduce your maintenance costs.

OTHER Q&C PRODUCTS: Switch Point Guards—One-piece Manganese Guard Rails—Wheel Stops—Derails—Gage Rods—Guard Rail Clamps—Car Replacers—Snow Flangers and Plows—Skid Shoes—Anti-Slip Rail Tongs—Flangeway Brackets—Foot and Heel Guards—Electric Snow Melters—Gaging Tools.

THE Q AND C COMPANY

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You can move big loads **FASTER, EASIER AND CHEAPER WITH**

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The new I.B. locomotive crane has air-operated controls that assure instant response and less operator fatigue. Anti-friction bearings at all essential points minimize maintenance. Rotating and travel friction disc clutches with one point adjustment reduce wear and strain on mechanism. One-piece massive cast steel bed insures rigidity of mechanism thus prolonging crane life. Monitor-type cab provides 360° visibility. For the engineered answer to your material handling problems, get the facts from I.B.

10-20 ton I.B. traveling coal bridge with 300 ft. span and raisable apron extending 110 ft from pier leg center line. Bucket is suspended from turntable mounted on man-riding trolley.

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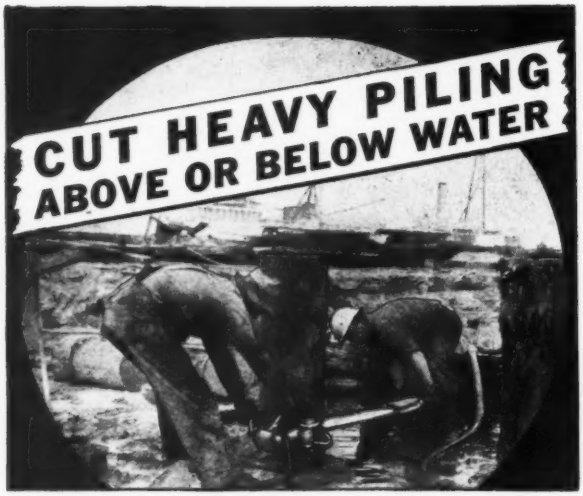

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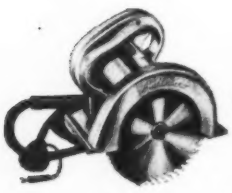
Specifications for speedy dock and bridge construction—harbor improvements—road building—and large engineering jobs call for the Mall pneumatic Chain Saw. This versatile heavy duty Power tool goes through a 12 x 12 in 10 seconds . . . it cuts piling within 2 inches of the ground . . . it can be used under water. Its 360 degree index allows horizontal, vertical or any angle cuts . . . its rotary type motor has an automatic oiler to simplify maintenance . . . the exhaust keeps the cutting chain free from dirt. Immediately available in 24, 36 and 48 inch cutting capacities.

MODEL 60



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Model 60 MallSaw rips and cross-cuts any kind of rough or dressed lumber up to 2 inches. When equipped with a Mall longwearing abrasive disc, it can be used for cutting and scoring tile, limestone, concrete and other aggregate compositions. The lightweight, rust proof aluminum alloy housing, comfortable handle with trigger switch, and perfect balance makes for easy handling. Available in 110-volt AC-DC or 220-volt AC-DC.

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Railroad Department

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Green Bay with her progressive business leaders, expanding population and rapidly growing industries has given a big OK to Layne Well Water Systems. With only one minor exception, all water producing equipment for the city bears the famous and always dependable name of Layne. That same foresighted preference which guided city officials was also true with her industries—Warehouse and Cold Storage Plants, Paper Mills, Public Service Companies, Breweries, Creameries, Milk Plants, Laundries, Soap Manufacturers, Food Processing Plants, Religious Charities, County Institutions, and many others.

The choice of Layne Well Water Systems was based upon proven performance and a definite knowledge of low operation cost. But in and near Green Bay, as elsewhere, Layne sturdy quality was not an overlooked factor.

Layne high efficiency Well Water Systems are precision built to very rigid standards of excellence. They embody the finest engineering features yet developed. For further convincing facts about Layne Well Water Systems and Layne high efficiency Vertical Turbine Pumps, write for literature. Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine Pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves on power cost.

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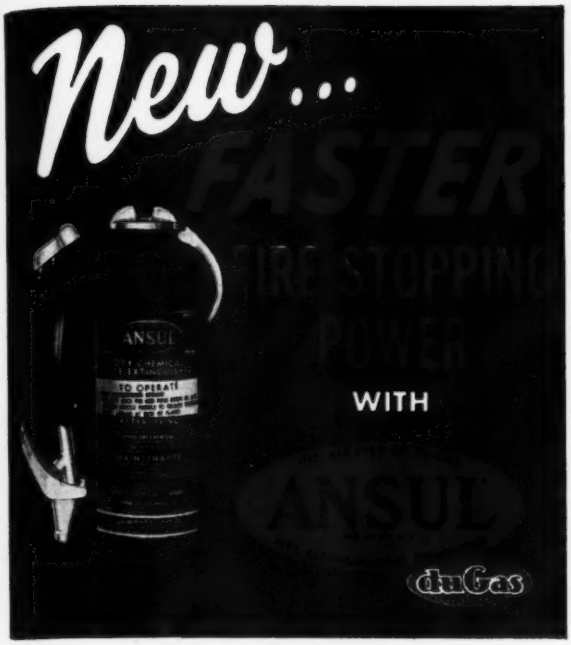
LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS



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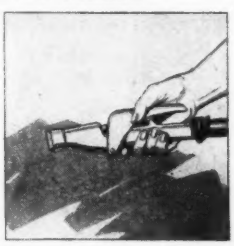
Install the NEW Ansul-Dugas Extinguishers at all hazard spots for greater protection against all fires involving flammable liquids, gases and electrical equipment.

Ready . . . in a Flash!

Simply remove ringpin and push lever down.



Open nozzle and direct chemical stream at base of flames.

53% More Fire Stopping Power

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Write today for new catalog and authoritative data showing characteristics of all types of approved hand fire extinguishers.

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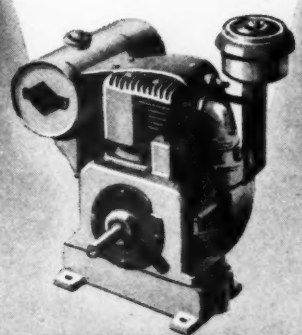

Air-Cooled 4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES *Power*

FOR TIGHT CORNERS
and
TOUGH SPOTS

Because Burro Cranes are designed and built to meet the specific needs of railroads, they are as efficient and practical on all maintenance-of-way, re-location or track laying as on the countless other odd jobs they do. Short tail swing of the Burro will not foul adjoining track and work can go on regardless of traffic. When Burro is working on single track, fast travel speeds and/or power set-off mechanism will get Burro off the track or to a side track in a hurry.

ONLY BURRO HAS ALL THESE FEATURES

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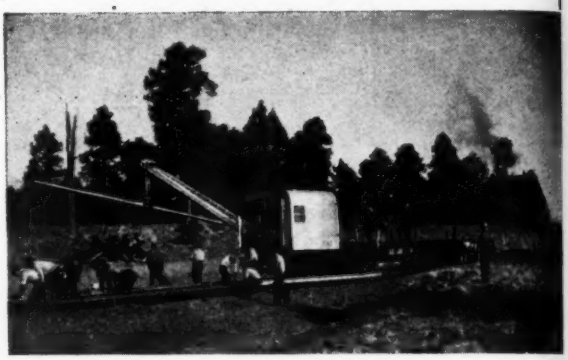
- Draw Bar Pull of 7500 lbs. (often eliminates need for work train or locomotive).
- Elevated Boom Heels for working over high sided gondolas.
- Short tail swing—will not foul adjoining track.
- Low overall height—Burro can be loaded and worked on a standard flat car.



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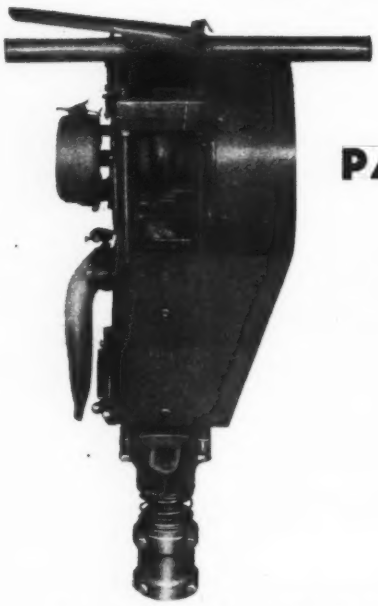

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PAVING BREAKERS
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SPIKE DRIVERS

100% Self-Contained

Heavy-duty "off-the-track" tools that will save your crews a lot of time—and save you money.
Entirely self-contained, they do not require auxiliary power equipment.
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WARWOOD
TRACK
TOOLS

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When you purchase Warwood Track Tools, you can rest assured they are accurately forged and scientifically heat treated to meet A. R. E. A. specifications. And whatever the purpose for which they are designed, they will do the job well and withstand severe service. The high quality of Warwood Track Tools makes them the number one choice among careful buyers. Specify Warwood for complete satisfaction.

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SINCE 1854
FORGED TOOLS

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OPERATING DEPENDABILITY
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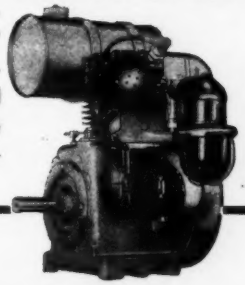
Air-Cooled ENGINES
on Your Motorized Equipment

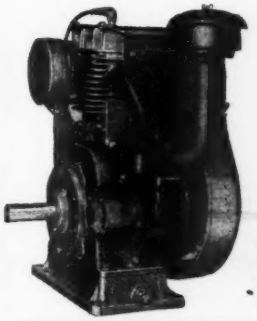
In the selection of suitable power units for your motorized equipment you are, of course, vitally interested in such factors as heavy-duty serviceability under all operating conditions; low maintenance costs; light weight; compact design—and trouble-free cooling in any weather, in any locality.

It is because Wisconsin Air-Cooled Engines so fully meet these requirements that they are now being so universally and extensively demanded and used for powering a wide variety of railway maintenance equipment within a 2 to 30 hp. range.

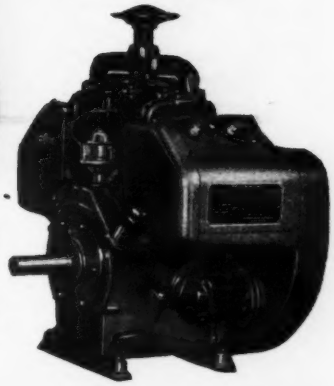
It pays to specify: "Wisconsin Air-Cooled Engine" when making up your purchase orders for motorized equipment or dependable power units wherever required.



Models AB and AK 4-cycle, single cyl. engine, 2 to 4 hp.



Models AEH, AFH, AGH, AHH 4-cycle, single cyl. standard engine, 3 to 9 hp.



Model VE-4, V-type, 4-cyl. standard engine, delivering 22 hp. at 2600 r.p.m.

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MILWAUKEE 14 WISCONSIN, U. S. A.
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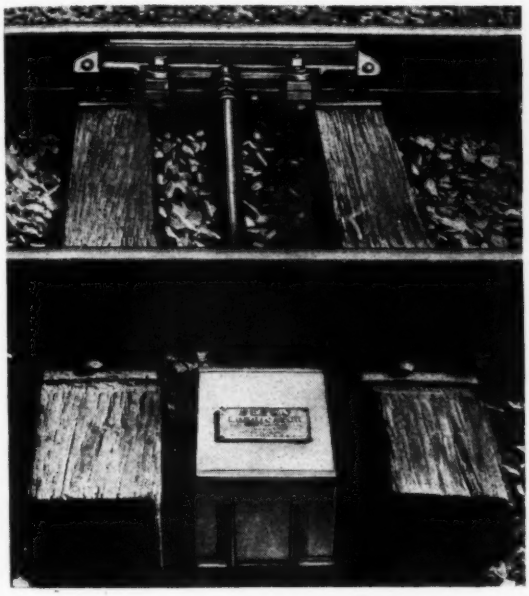
Rail and Flange Lubricators



Sesmo Automatic Rail and Flange Lubricator

AUTOMATIC oiling of rails and wheel flanges reduces friction—cuts down maintenance costs—increases tonnage capacity and permissive speed over curved track.

The "Sesmo" type lubricator shown above is the culmination of Ardco's long experience in the railroad field.

Properly located, these lubricators will pay for themselves many times over in less frequent replacement of curve rails—less tire turning—increased safety.

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- Force feed action actuated by wave motion of rail.
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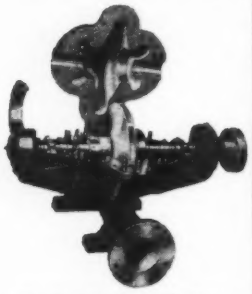

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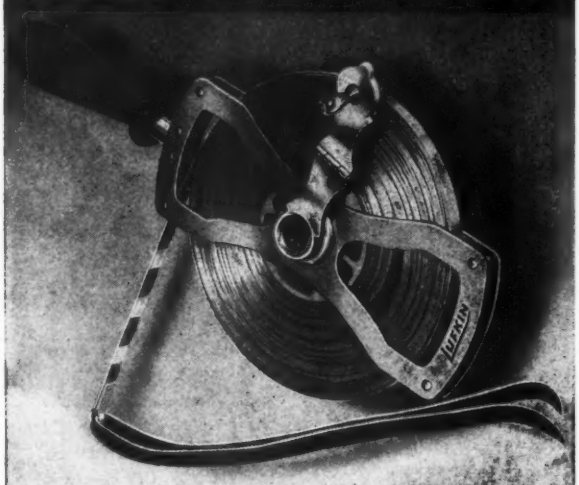

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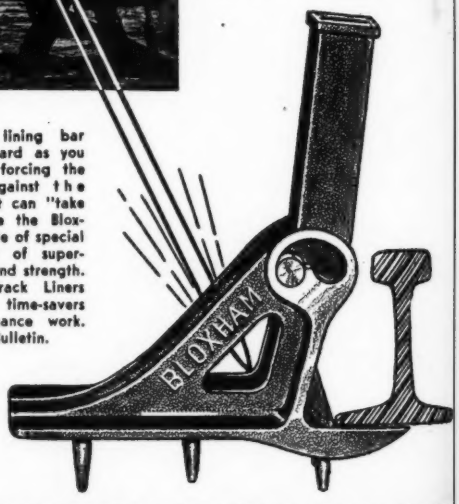

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No. 2522: Capacity 25-tons; height 22"; lift 10¼".

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Simplex No. 2522 Standard Speed Jack, lifts 25 tons with ease and safety, and is ideal for bridge, trestle and viaduct construction and maintenance work. The broad toe lift is 4⅜" from ground level when in closed position. Mechanism is at the top of the Jack, up and out of the dirt.

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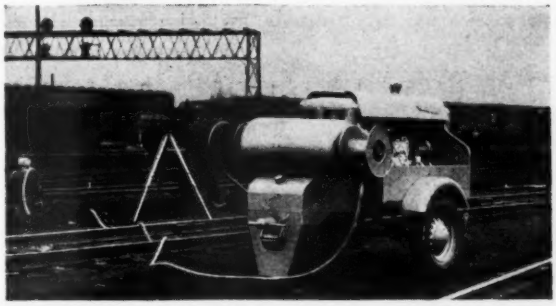

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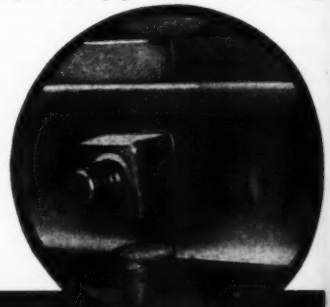

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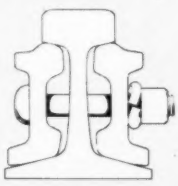

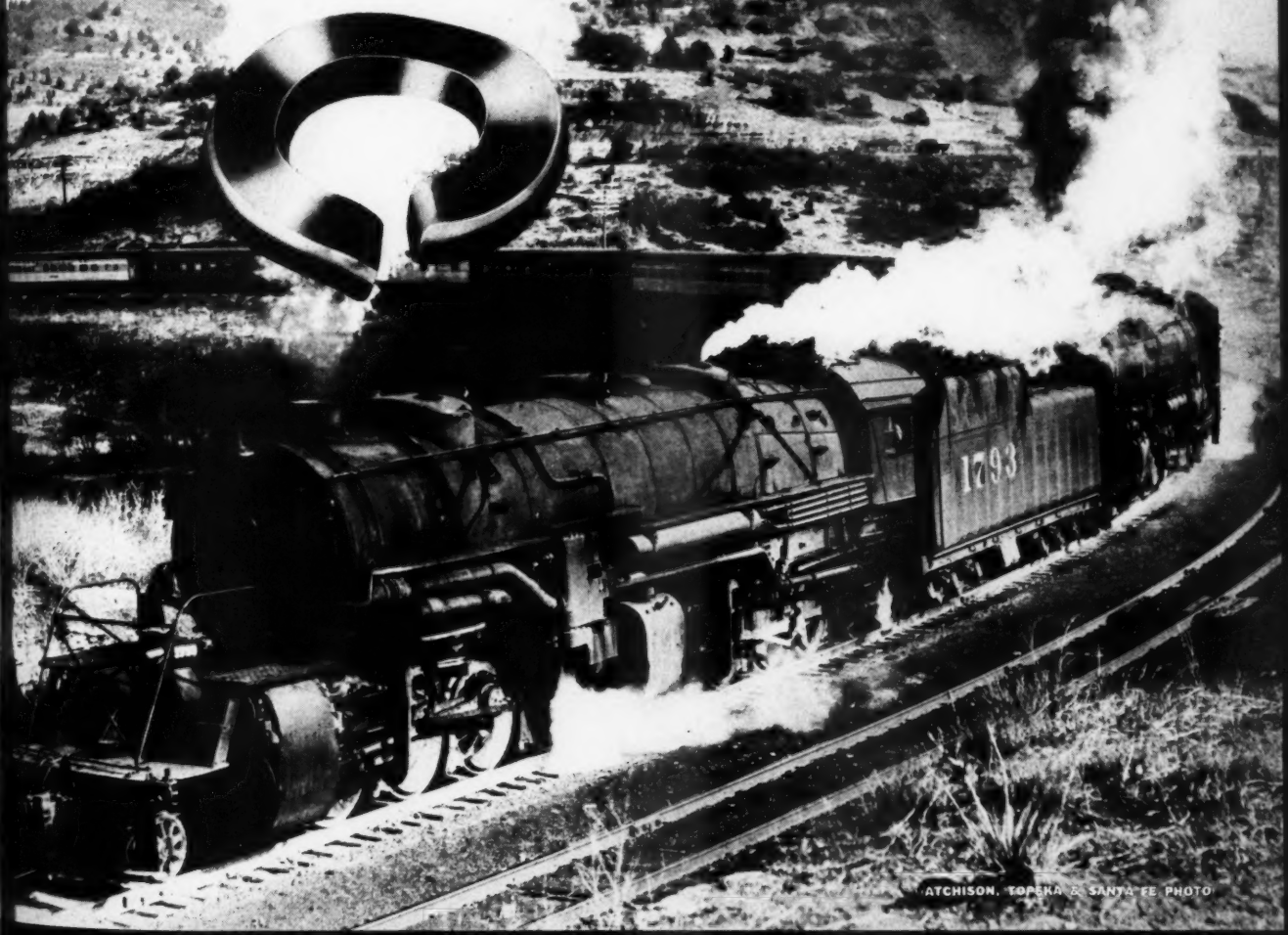

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